

TRANSMITTAL LETTER  
(General - Patent Pending)Docket No.  
WSP241US

In Re Application Of: Knut Asendorf et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/557,620	November 18, 2005	n/a	24041	n/a	n/a

Title: MEANS AND METHOD FOR SEALING CONSTRUCTIONS

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Dated: March 31, 2006

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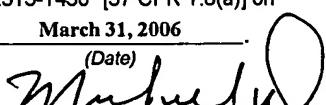
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March 31, 2006

(Date)


  
Signature of Person Mailing Correspondence

Michael L. Dunn

Typed or Printed Name of Person Mailing Correspondence

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Consolid Technik Deutschland GmbH & Sächsische Bau GmbH

Application No.: 10/557,620 (PCT/DE2004/000528)

Filing Date: November 18, 2005

For: MEANS AND METHOD FOR SEALING  
CONSTRUCTIONS

Attorney Docket No. WSP241US

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**RESPONSE**

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Dear Wanda Banks:

In response to the letter received from you dated 23 March 2006 (copy enclosed), advising of non-receipt of the Petition to Revive the above-referenced application, we are attaching a copy of all documents (which includes the Petition for Revival) sent to the U.S. Patent & Trademark Office to Mail Stop PCT and Attention to PCT Legal on November 18, 2005. We are also attaching a copy of the stamped Express Mail Receipt (#EV7313872357US), copies of the front and back of the canceled check which paid for the fees for this case and the acknowledgement postcard which we received back from the U.S. Patent & Trademark Office on December 5, 2005, proving that the USPTO did receive the original package as of the date stamp of November 18, 2005.

In view of the loss of this Petition by the U.S. Patent & Trademark Office, causing a delay of four (4) months, we hope it will now be acted upon immediately.

Respectfully submitted,



Michael L. Dunn  
Registration No. 25,330  
Attorney for Applicant  
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5555 Main Street  
Williamsville, New York 14221

Dated: March 31, 2006

MLD/MJK  
Encs.

cc: Dr. Winfried Lieke

23 MAR 2006

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Michael L. Dunn  
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Dear Mr. Dunn:

This is in response to your communication received 24 February 2005, inquiring about the status of a petition to revive PCT/DE2004/00528 (U.S. Serial No. 10/557,620). USPTO records appear to have no record of said petition. You may fax the petition to PCT Legal Administration at (571) 273-0459, or via the US Postal Service to "Box PCT" at the address above.

Wanda Banks  
Paralegal Specialist  
PCT Legal Office  
Tel: (571) 272-3277  
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Applicant: Knut Asendorf et al. U.S. Nationalization of PCT/DE2004/000528

International Filing Date: March 16, 2004

Priority Date: March 19, 2003 Priority Application No. DE10312325.3

For: MEANS AND METHOD FOR SEALING CONSTRUCTIONS

Transmitted herewith is: **1A PTO Rec'd PCT/PTO 18 NOV 2005**

- 1) Petition for Revival of an International Application for Patent Designating the U.S. Abandoned Unintentionally Under 37 CFR 1.137(b)
- 2) Copy of the International Application No. WO 2004/08352 A1 with International Search Report
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- 5) Signed Declaration and Power of Attorney
- 6) Transmittal Letter Concerning a Filing Under 35 USC 371
- 7) Specification and three (3) sheets of drawings (7 figures)
- 8) Acknowledgement postcard
- 9) Express Mail Document No. EV731382357US
- 10) Copy of International Preliminary Report on Patentability
- 11) Preliminary Amendment
- 12) Application Data Sheet

Attorney Docket No. 1032.WSP241US Customer No. 24041

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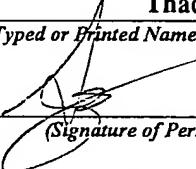
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Application No.  
n/aFiling Date  
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24041Group Art Unit  
n/aInvention: **MEANS AND METHOD FOR SEALING CONSTRUCTIONS**

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**New U.S. Nationalization Patent Application with Petition to Revive and related documents***(Identify type of correspondence)*

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## MEANS AND METHOD FOR SEALING CONSTRUCTIONS

5 The invention concerns a means for and methods of sealing constructions, in particular earthwork constructions.

Means for and methods of sealing constructions, for example dams and dikes, which use concrete, for example water-impermeable concrete, as a sealing means, are known from the state of the art. The water-impermeable concrete can be introduced into 10 already existing dikes through slot walls or bung bores. That procedure is disadvantageous however precisely in relation to dikes as a rigid body is formed within the dike, which cannot compensate for shifts in the foundation soil so that breaks and cracks can occur in the concrete sealing means. Cracks in the sealing means however mean that the dike or generally the construction becomes water-permeable again and 15 there is the risk of underscouring.

In comparison the use of argillaceous mixtures for sealing constructions, earlier known as 'puddle', affords the advantage that this kind of sealing does not form a rigid sealing body so that shifts in foundation soil are compensated and no leaks can occur. Sealing arrangements for constructions comprising argillaceous mixtures involve 20 water-impermeability of approximately the same level as sealing arrangements using concrete. Puddles on the dam outside are also relatively complicated and expensive, require a great deal of construction material, destroy the biotop on the dam surface and do not have particularly long service lives. They are also limited to use in relation to dams or dikes which can be dry at least during the building phase.

25 In comparison with the state of the art the object of the invention is to provide a means for and a method of sealing constructions, which permits new and already existing constructions to be flexibly, inexpensively and permanently sealed with a high degree of sealing integrity, by the introduction of a core sealing means.

That object is attained in that the means for sealing constructions comprises a 30 mixture of argillaceous materials and an additive which breaks open the enclosing water around the grain of the soil, wherein 1m<sup>3</sup> of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably

0.03% by volume of the additive. In comparison with the conventional argillaceous mixtures such as for example bentonite, that modified soil mixture exhibits a substantially improved sealing action, wherein the flexible properties of the argillaceous mixtures from the state of the art are still retained. The quantitative ratio 5 according to the invention between the additive and the soil achieves optimum water-impermeability. In that respect the concentration of the additive should not substantially exceed 0.5% by volume as, at higher levels of concentration, the additive has a film-forming effect around the soil.

Introduction of the additive according to the invention into the soil mixture, by 10 virtue of the water casing which generally surrounds the individual grain being broken open, obviously results in better coagulation by virtue of the stronger adhesion forces with which the individual particles of the soil can adhere to each other after their water casing has been broken open. By virtue of using the additive in the preferred embodiment of the invention, this provides that the mixture acquires a compact, 15 viscous-plastic and water-impermeable consistency. Even after a forced drying-out operation the mixture remains stable and upon absorbing a small amount of water immediately assumes again the viscous-plastic, water-impermeable consistency. Because of the strong cohesion between the grains, plant roots cannot pass through the sealing means, nor can it be infested by small animals. In addition adjunction works are 20 possible at any time as the mixture does not set. Undermining and erosion of the injection body in the case of flowing water does not occur.

In a preferred embodiment the additive is a polymer, in particular a polymeric (meth)acrylamide. When using polymeric additives K-values around  $10^{-9}$  m/second are achieved. A possible explanation for achieving the high K-values could be the dense 25 bedding of the soil constituents and the fact that the pores in the structure are filled up by the clay particles.

In addition a particularly preferred embodiment of the invention is one in which the additive contains saponified paraffins. The use of the polymeric (meth)acrylamide in conjunction with saponified paraffins is ecologically harmless so that the sealing 30 means can be used in all ground water zones. Because of the low level of concentration of the additive a binding agent function is not possible and desired and is also not effected by any cement or lime admixtures, the concentration of which would also be

too low for that purpose. There is no chemical reaction with the additive, but it acts substantially with a hydrophobing effect on the grain. Its action is comparable to that of a catalyst.

It is desirable if the soil in the present invention contains clay and/or coarse 5 clay. A proportion of at least 10% by weight, preferably at least 15% by weight of clay and/or coarse clay has proven to be particularly advantageous. It is precisely the fine-grain constituents such as clay or coarse clay in the soil that, in conjunction with the additive, permit the formation of a compact, viscous-plastic and water-impermeable mass.

10 A preferred embodiment of the invention provides that a proportion of cement and/or lime which in turn contains a proportion of 1% by weight to 10% by weight, preferably 3.5% by weight of the additive, is added to the mixture. That addition is advantageous as it dilutes the additive and for example facilitates uniform distribution of the additive when injecting the mixture into an already existing construction. In that 15 respect a particularly preferred embodiment of the invention is one in which between 15 kg and 25 kg, preferably 20 kg of the cement or lime containing the additive, is added to one cubic metre of soil. That amount permits optimum dilution of the additive upon injection into an existing construction. Mixing of additive and cement and/or lime can take place at the factory, that is to say not on site.

20 In order to make the mixture capable of flow, it is desirable if a proportion of between 20% by weight and 50% by weight, preferably between 25% by weight and 40% by weight and particularly preferably between 30% by weight and 35% by weight of water is added to the mixture. With that water content the mixture has thixotropic properties, that is to say the material can be pumped and conveyed but becomes jelly-like firm as soon as it comes to rest. After the excess water issues the Proctor density of 25 the mixture is reached, that is to say with that water content, optimum compacting of the soil and the additive is achieved.

30 In regard to the method the object of the invention is achieved in that a mixture of soil and an additive, as has been described hereinbefore, is injected into a construction or is sprayed on at the surface using a wet flow method. That procedure makes it possible for an already existing construction to be sealed off subsequently, that is to say even years after it was constructed.

In a preferred embodiment of the invention firstly holes are bored into the construction, the hole walls being stabilised. The soil is then flushed out of the walls of the holes and a mixture of soil and an additive as has been described hereinbefore is pressed into the hole. That method makes it possible for the additive to be introduced 5 even into constructions whose soil is already so greatly compacted that the additive cannot be introduced through cavities and/or porous intermediate spaces in the soil.

In a particularly preferred embodiment the walls of the bore holes are supported with a tube which has slots and the soil is flushed out through the slots and the mixture of soil and an additive as has been described hereinbefore is pressed into the 10 construction through same or other adjacent slots or openings. Supporting the bore holes with a slotted tube prevents the walls of the bore holes falling in during the works and thus hindering the introduction of the sealing means into the construction. In that case the slotted tube advantageously remains in the bore hole during all stages.

In a particularly preferred embodiment of the method of the invention the 15 operation of flushing out the soil and the operation of introducing the mixture of soil and additive are effected in one working step.

Depending on the foundation soil composition it may be desirable if additional substances with a high fine proportion, preferably clay and/or coarse clay, are added to the mixture of soil and an additive as has been described hereinbefore. That makes it 20 possible for even constructions whose soil contains only small fine proportions to be subsequently very effectively sealed with the aforesaid method.

As an alternative to the specified method, in the case of injectable grounds, it may be advantageous for the above-described additive to be directly injected into cavities, holes and/or into the porous intermediate spaces of the soil of the construction 25 so that it mixes there with the soil. That method permits introduction of the additive into the construction with a low level of complication and expenditure.

In a preferred embodiment of the invention rotating boring lances are used for injection of the mixture of soil and an additive in order to build up a cylindrical body of sealing material in the construction, with a defined injection pressure.

30 Further advantages, features and possible uses of the present invention will be apparent from the description hereinafter of a preferred embodiment and the related Figures in which:

Figure 1 shows a diagrammatic representation of the soil exchange process,

Figure 2 shows a diagrammatic representation of the injection of mixture of soil and additive into a bore hole,

Figures 3a – c show diagrammatic representations of the stepwise procedure in 5 the injection of the mixture of soil and an additive into a bore hole,

Figure 4 shows a lateral view in section through a river dike with bore holes,

Figure 5 shows a diagrammatic sectional view of a construction below ground level with surface sealing,

Figure 6 shows a diagrammatic sectional view of a tunnel construction with 10 various sealing arrangements, and

Figure 7 shows a sectional view of a dike with vertical sealing.

Figure 1 diagrammatically shows the exchange of the soil 1 by a mixture of the previously removed soil 1 and an additive 3. In the illustrated embodiment the additive used is a polymeric acrylamide in conjunction with saponified paraffins. That additive 15 can be obtained under the trade name Consolid. Water is introduced into a slotted tube 4 under high pressure through a conduit 5 so that the soil is flushed out at the slots 6 of the tube. The mixture of soil and water is then sucked away from the slotted tube 4 by way of a conduit 7. After settlement in a settlement tank 8 the mixture of soil and water is mixed in a mixer 9 with parts of the drilling material 10 and the additive 3. Soil can 20 possibly be mixed in the mixer with a higher fine proportion, for example coarse clay and/or clay. The modified clay mixture is then passed by way of a further conduit 12 back into a region 13 under the removal location of the slotted tube 4, under pressure. There it is used for filling the wall region 6 from which soil 1 was previously flushed out. In a concluding working operation, the slotted tube 4 is drawn out of the bore hole 25 and the bore hole is filled with the modified clay mixture 2.

Figure 2 diagrammatically shows the step of injecting the modified clay mixture with an additive, here Consolid, and optionally additional fine components, into a bore hole 4. For that purpose a hole 4 is bored with a rotating boring lance 14 and at the same time the modified clay mixture 2 is pressed thereinto.

30 That can be particularly clearly seen in Figures 3a – c. Figures 3a and b show how the modified clay mixture is pressed into the bore hole during the operation of boring the hole with the lance 14. It can be seen in this respect how the modified clay

mixture 2 also penetrates into the soil 1 in the regions 15 directly adjoining the bore hole 4.

Figure 3c shows two mutually juxtaposed bore holes 4 which are already filled with the modified clay mixture 2. Their edge or surrounding regions 15 which are also 5 penetrated by the modified clay mixture overlap in a region 16 so that in cross-section there is a continuous sealing surface formed from the modified clay mixture.

Figure 4 particularly clearly shows the formation of a continuous sealing surface within a river dike. The choice of the arrangement of the bore holes 4 provides respective overlapping surrounding regions 6 around the bore holes, which are 10 permeated by the sealing mixture, so that an interruption-free sealing arrangement in an already existing dike can be built up without having to excavate the dike over its entire length.

Figure 5 shows an underground construction, the bottom surface 18 of which has been sealed with two sealing surfaces 19 of the modified clay mixture 2.

15 Figure 6 shows a tunnel, the rear surface 20 of which has been provided in the upper region with a seal 20 of the modified clay mixture 2. In addition it is also possible to see a seal 22 of modified clay mixture 2, which covers over the region of the tunnel tubes and the adjacent earth. Such cover arrangements are frequently used in the field of underground railway construction in which further traffic levels are arranged 20 over the tunnel tubes. A further seal 23 in the region laterally of the tunnel tubes 24 can prevent for example ground water from penetrating into the tunnel tubes 24.

Figure 7 shows a so-called vertical seal 20 of a dike 17. For that purpose slots are excavated into the dike perpendicularly to the top thereof, in this case two slots, the slots being filled with the modified clay mixture 2 to seal off the dike 17.

CLAIMS

1. A means for sealing constructions comprising a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive which breaks open the enclosing water around the grain, wherein 1m<sup>3</sup> of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably 0.03% by volume of the additive.
2. A means for sealing constructions according to claim 1 characterised in that the additive is a polymer, in particular a polymeric (meth)acrylamide.
3. A means for sealing constructions according to claim 1 or claim 2 characterised in that the additive contains saponified paraffins.
4. A means for sealing constructions according to one of claims 1 to 3 characterised in that the soil contains a proportion of at least 10% by weight, preferably at least 15% by weight of clay and/or coarse clay
5. A means for sealing constructions according to one of claims 1 to 4 characterised in that a proportion of cement and/or lime which in turn contains a proportion of 1% by weight to 10% by weight, preferably 3.5% by weight of the additive, is added to the mixture.
6. A means for sealing constructions according to claim 5 characterised in that between 15 kg and 25 kg, preferably 20 kg of the cement or lime containing the additive, is added to 1 m<sup>3</sup> of soil.
7. A means for sealing constructions according to one of claims 1 to 6 characterised in that a proportion of between 20% by weight and 50% by weight, preferably between 20% by weight and 40% by weight and particularly preferably between 30% by weight and 35% by weight of water is added to the mixture to make it capable of flow.

8. A method of sealing constructions in which a mixture of soil and an additive according to one of claims 1 to 7 is injected into the construction or sprayed on at the surface.

9. A method of sealing constructions according to claim 8 characterised in that holes are bored into the construction, the walls of the holes being stabilised, that the soil is flushed out of the walls of the holes and then a mixture of soil and an additive according to one of claims 1 to 7 is pressed into the hole.

10. A method of sealing constructions according to claim 9 characterised in that the walls of the bore holes are supported with a tube which has slots and the soil is flushed out through the slots and the mixture of soil and an additive according to one of claims 1 to 7 is pressed into the construction through the slots.

11. A method of sealing constructions according to one of claims 8 to 10 characterised in that substances with a high fine proportion, preferably clay and/or coarse clay, are added to the mixture of the soil and an additive according to one of claims 1 to 6.

12. A method of sealing constructions wherein an additive according to one of claims 1 to 7 is injected into cavities, holes and/or into the porous intermediate spaces of the soil of the construction and there mixed with the soil.

13. A method according to one of claims 8 or 12 characterised in that the additive or the mixture of soil and additive is injected into the construction by way of a rotating boring lance.

## Abstract

The present invention relates to a means for and a method of sealing constructions. In order to provide a means for and a method of sealing constructions which permits flexible, inexpensive and permanent sealing of new and already existing constructions, with a high degree of sealing integrity, by introducing a core sealing means, it is proposed in accordance with the invention that the means for sealing constructions comprises a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive for breaking open the enclosing water around the grain. In regard to the method it is proposed that the mixture of soil and an additive is injected into the construction or is sprayed on at the surface.

Fig. 1

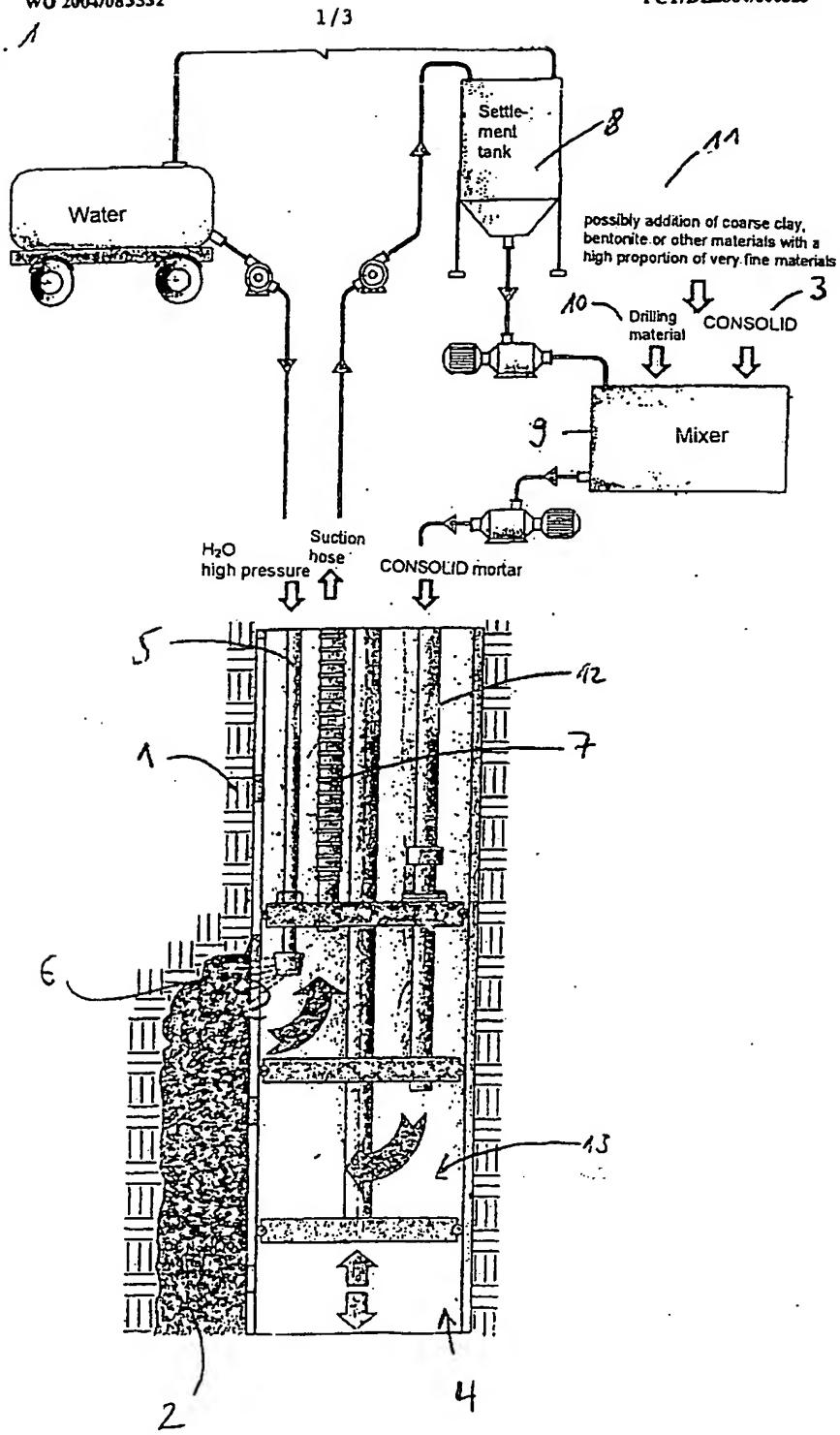


Fig 2

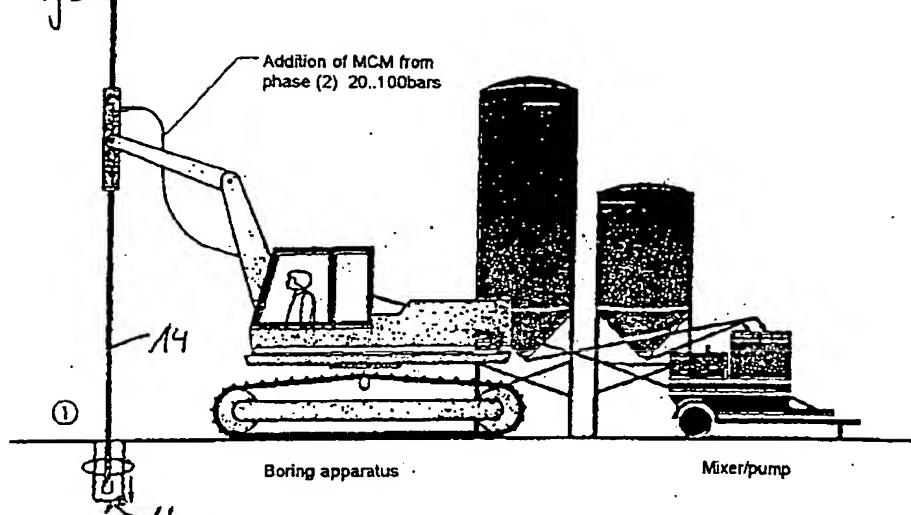


Fig 3 a) ② b) ③ c) ④

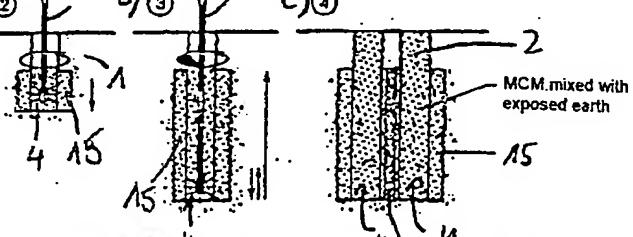
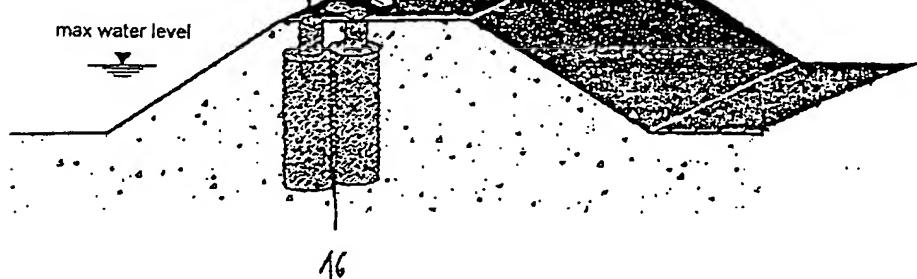


Fig 4

Example of use  
subsequently sealing river dike



3/3

Fig. 5

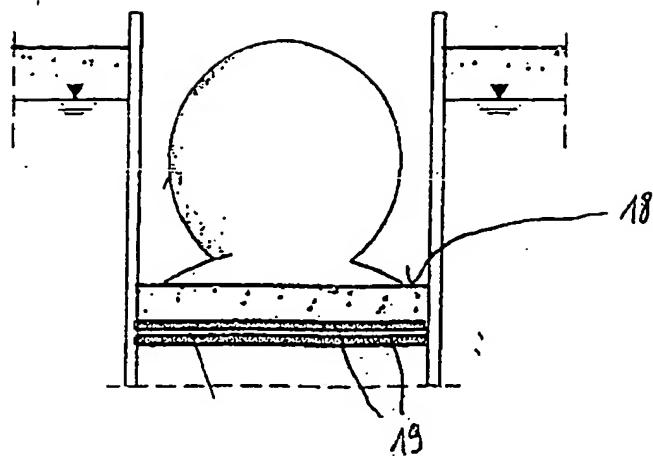


Fig. 6

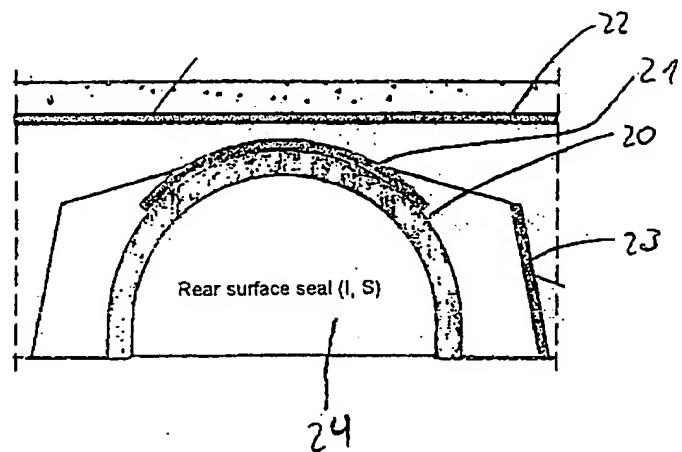
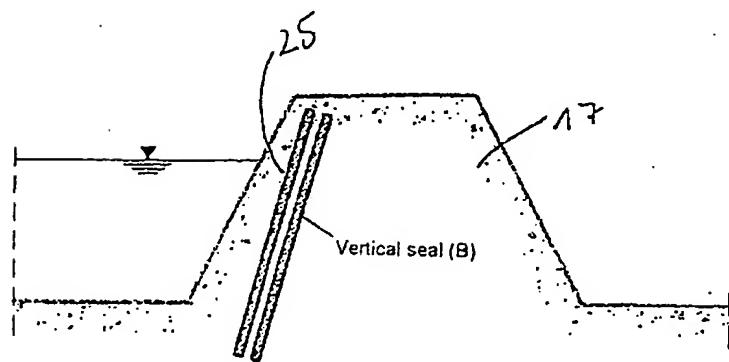


Fig. 7



Docket No.

## Declaration and Power of Attorney For Patent Application

## **English Language Declaration**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

## MEANS AND METHOD FOR SEALING CONSTRUCTIONS

the specification of which

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is attached hereto.

was filed on March 16, 2004 as United States Application No. or PCT International Application Number PCT/DE2004/000528.

and was amended on

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, or plant breeder's rights certificate(s), or 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed</u>
DE10312325.3 (Number)	Germany (Country)	19 March 2003 (Day/Month/Year Filed)	<input checked="" type="checkbox"/>
 (Number)	 (Country)	 (Day/Month/Year Filed)	<input checked="" type="checkbox"/>
 (Number)	 (Country)	 (Day/Month/Year Filed)	<input checked="" type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Robert P. Simpson, Esq., Reg. No. 33034

all of the firm of:

Michael L. Dunn, Esq., Reg. No. 25330

Simpson & Simpson, PLLC

C. Richard Lohrman, Esq., Reg. No. 46878

5555 Main Street

Howard M. Ellis, Esq., Reg. No. 25856

Williamsville, New York 14221

Thomas J. Colson, Esq., Reg. No. 38848

Customer No. 24041

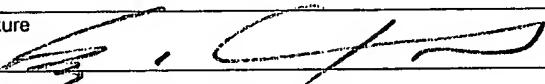
C. Paul Maliszewski, Reg. No. 51990

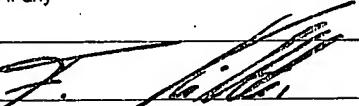
R. Craig Kauffman, Esq., Reg. No. 20362

Send Correspondence to: Michael L. Dunn  
Simpson & Simpson, PLLC  
5555 Main Street  
Williamsville, New York 14221

Direct Telephone Calls to: (name and telephone number)

Michael L. Dunn (716) 626-1564

Full name of sole or first inventor <b>Knut Asendorf</b>	Date
Sole or first inventor's signature 	08.11.05
Residence Hasenrecherweg 24, 55543 Bad Kreuznach, Germany	
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Full name of second inventor, if any <b>Falk Kittler</b>	Date
Second inventor's signature 	14.11.05
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Citizenship Germany	
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Attorney Docket No. WSP241US  
PCT Application PCT/DE2004/000528  
Inventors: Knut Asendorf et al.  
Date: November 18, 2005

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

U.S. Patent Application No.: n/a

Confirmation No.: n/a

PCT Application PCT/DE2004/000528

Applicant(s): Knut Asendorf et al.

Customer No.: 24041

Filed: PCT Application Date March 16, 2004

For: MEANS AND METHOD FOR SEALING CONSTRUCTIONS

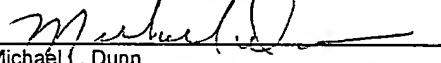
TC/Art Unit: n/a

Certificate of Mailing by Express Mail

Examiner: n/a

I certify that this Preliminary Amendment is being deposited on November 18, 2005 with the U.S. Postal Service "Express Mail Post Office Addressee" service under 37 C.F.R. §1.10 and is addressed to The Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Docket No.: WSP241US

  
Michael L. Dunn  
Express Mail Document No. EV731382357US

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

Honorable Sir:

Please amend the above identified patent application as follows:

Amendments to the claims begin on page 2 of this amendment.

Attorney Docket No. WSP241US  
PCT Application PCT/DE2004/000528  
Inventors: Knut Asendorf et al.  
Date: November 18, 2005

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

Please amend the claims as follows:

**What is claimed is:**

1. (original) A means for sealing constructions comprising a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive which breaks open the enclosing water around the grain, wherein 1m<sup>3</sup> of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably 0.03% by volume of the additive.

2-13 (cancelled)

Respectfully submitted,

  
Michael L. Dunn  
Registration No. 25330  
Simpson & Simpson, PLLC  
5555 Main Street  
Williamsville, NY 14221-5406  
Telephone No. 716-626-1564

MLD/mjk  
Encs.

Dated: November 18, 2005

TITLE: MEANS AND METHOD FOR SEALING CONSTRUCTIONS  
FIRST NAMED APPLICANT Knut Asendorf et al.  
U.S. FILING/NATIONALIZATION DATE: n/a  
PCT FILING DATE: March 16, 2004  
PCT APPLICATION NUMBER: PCT/DE2004/000528  
ATTORNEY DOCKET NUMBER: WSP241US

APPLICATION DATA SHEET (PAGE 1)

1 Applicant Information:

1) First applicant

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Citizenship: Germany

2) Second applicant

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Citizenship: Germany

3) Third applicant

Complete Name:  
Residence Address:  
Mailing Address, if different:  
Citizenship:

4) Fourth applicant

Complete Name:  
Residence Address:  
Mailing Address, if different:  
Citizenship:

5) Fifth applicant

Complete Name:  
Residence Address:  
Mailing Address, if different:  
Citizenship:

2. Correspondence Information:

Attorney or agent name: Michael L. Dunn  
Attorney or agent registration number: 25330  
Mailing address: Simpson & Simpson, PLLC  
5555 Main Street, Williamsville, NY 14221  
Phone number: 716-626-1564  
Fax number: 716-626-0366  
Customer number: 24041

TITLE: MEANS AND METHOD FOR SEALING CONSTRUCTIONS  
FIRST NAMED APPLICANT: Knut Asendorf et al.  
U.S. FILING/NATIONALIZATION DATE: n/a  
PCT FILING DATE: March 16, 2004  
PCT APPLICATION NUMBER: PCT/DE2004/000528  
ATTORNEY DOCKET NUMBER: WSP241US

APPLICATION DATA SHEET (PAGE 2)

3. Application Information:

Title: MEANS AND METHOD FOR SEALING CONSTRUCTIONS  
U. S. filing/nationalization date: n/a  
PCT filing date: March 16, 2004  
PCT application number: PCT/DE2004/000528  
Number of drawing sheets: 3  
Application type:  utility  design  provisional  reissue  plant  
Attorney docket number: WSP241US

4. Representative Information:

Customer number: 24041

5. Domestic Priority Information: priority is claimed from:

1) Application number:

Filing date:

Status:  pending  granted  patent number  
Relationship  priority under 35 U.S.C. 119(e) (from provisional application)  
 priority under 35 U.S.C. 120 (as a continuation application)  
 priority under 35 U.S.C. 121 (as a divisional application)  
 priority under 35 U.S.C. 365(c) (from PCT application)

2) Application number:

Filing date:

Status:  pending  granted  patent number  
Relationship  priority under 35 U.S.C. 119(e) (from provisional application)  
 priority under 35 U.S.C. 120 (as a continuation application)  
 priority under 35 U.S.C. 121 (as a divisional application)  
 priority under 35 U.S.C. 365(c) (from PCT application)

3) Application number:

Filing date:

Status:  pending  granted  patent number  
Relationship  priority under 35 U.S.C. 119(e) (from provisional application)  
 priority under 35 U.S.C. 120 (as a continuation application)  
 priority under 35 U.S.C. 121 (as a divisional application)  
 priority under 35 U.S.C. 365(c) (from PCT application)

TITLE: MEANS AND METHOD FOR SEALING CONSTRUCTIONS  
FIRST NAMED APPLICANT: Knut Asendorf et al.  
U.S. FILING/NATIONALIZATION DATE: n/a  
PCT FILING DATE: March 16, 2004  
PCT APPLICATION NUMBER: PCT/DE2004/000528  
ATTORNEY DOCKET NUMBER: WSP241US

APPLICATION DATA SHEET (PAGE 3)

6. Foreign Priority Information: priority under 35 U.S.C. 119 is claimed from:

- 1) Application number: 10312325.3  
Country: Germany  
Filing date: March 19, 2003  
Status:  pending  granted  patent number
- 2) Application number:  
Country:  
Filing date:  
Status:  pending  granted  patent number
- 3) Application number:  
Country:  
Filing date:  
Status:  pending  granted  patent number

7. Assignee Information:

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- 2) Name: Sächsische Bau GmbH  
Address: Am Waldschlößchen 1  
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<b>PETITION FOR REVIVAL OF AN INTERNATIONAL APPLICATION FOR PATENT DESIGNATING THE U.S. ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(b)</b>		Docket Number (Optional) <b>WSP241US</b>
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First Named Inventor: **Knut Asendorf et al.**International (PCT) Application No.: **PCT/DE2004/000528**U.S. Application No.: **N/A**  
(if known)Filed: **March 16, 2004**Title: **MEANS AND METHOD FOR SEALING CONSTRUCTIONS**

Attention: PCT Legal Staff  
 Mail Stop PCT  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

The above-identified application became abandoned as to the United States because the fees and documents required by 35 U.S.C. 371(c) were not filed prior to the expiration of the time set in 37 CFR 1.495(b) or (c) as applicable. The date of abandonment is the day after the date on which the 35 U.S.C. 371(c) requirements were due. See 37 CFR 1.495(h).

#### **APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION**

NOTE: A grantable petition requires the following items:

- (1) Petition fee
- (2) Proper reply
- (3) Terminal disclaimer with disclaimer fee which is required for all international applications having an international filing date before June 8, 1995; and
- (4) Statement that the entire delay was unintentional.

## 1. Petition fee

Small entity-fee \$ **\$750.00** (37 CFR 1.17(m)). Applicant claims small entity status.  
 See 37 CFR 1.27.

Other than small entity-fee \$ \_\_\_\_\_ (37 CFR 1.17(m))

## 2. Proper reply

A. The proper reply (the missing 35 U.S.C. 371 (c) requirement(s)) in the form of  
**all documents and fees required by 37CFR1.495bandc** (identify type of reply):

has been filed previously on \_\_\_\_\_

is enclosed herewith.

[Page 1 of 2]

This collection of information is required by 37 CFR 1.137(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## 3. Terminal disclaimer with disclaimer fee

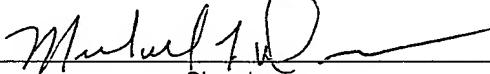
Since this international application has an international filing date on or after June 8, 1995, no terminal disclaimer is required.

A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of \$ \_\_\_\_\_ for a small entity or \$ \_\_\_\_\_ for other than a small entity) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

## 4. Statement. The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional.

## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.



Signature

November 18, 2005

Date

25330

Registration Number, if applicable

716-626-1564

Telephone Number

Michael L. Dunn

Typed or Printed Name

Simpson &amp; Simpson, PLLC

Address

5555 Main Street, Williamsville, NY 14221

Address

Enclosures:  Response Fee Payment Terminal Disclaimer Other (please identify):

- 1) Copy of the International Application No. WO 2004/08352 A1 with International Search Report
- 2) Check for \$1,395.00 [Includes Basic National Fee (\$150), Examination Fee (\$100), Search Fee (\$200), \$65 Surcharge for late search fee, examination fee and late Declaration; and Petition Fee (\$750)], all Small Entity Fees; and \$130 Processing Fee for furnishing late English translation
- 3) English translation of International Application
- 4) Signed Declaration and Power of Attorney
- 5) Transmittal Letter Concerning a Filing Under 35 USC 371
- 6) Specification and three (3) sheets of drawings (7 figures)
- 7) Acknowledgement postcard
- 8) Express Mail Document No. EV731382357US
- 9) Copy of International Preliminary Report on Patentability
- 10) Preliminary Amendment
- 11) Application Data Sheet

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES  
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum  
Internationales Büro



(43) Internationales Veröffentlichungsdatum  
30. September 2004 (30.09.2004)

PCT

(10) Internationale Veröffentlichungsnummer  
**WO 2004/083532 A1**

(51) Internationale Patentklassifikation<sup>7</sup>: E02D 3/12, Bensheim (DE). SÄCHSISCHE BAU GMBH [DE/DE]; C09K 17/00, 3/10, C04B 26/02 Am Waldschlösschen 1, 01099 Dresden (DE).

(21) Internationales Aktenzeichen: PCT/DE2004/000528 (72) Erfinder; und  
(75) Erfinder/Anmelder (nur für US): ASENDORF, Knut [DE/DE]; Hasenrecherweg 24, 55543 Bad Kreuznach (DE). KITTNER, Falk [DE/DE]; Bergmannsteig 2, 09557 Flöha (DE).

(22) Internationales Anmeldedatum: 16. März 2004 (16.03.2004) (74) Anwälte: WEBER, Dieter usw.; Postfach 61 45, 65051 Wiesbaden (DE).

(25) Einreichungssprache: Deutsch (81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG.

(26) Veröffentlichungssprache: Deutsch

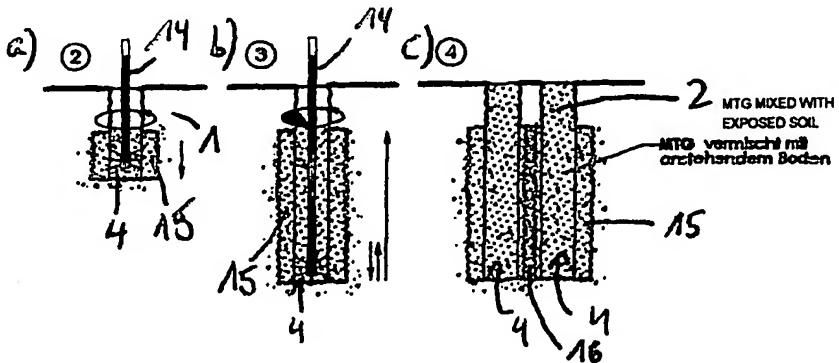
(30) Angaben zur Priorität: 103 12 325.3 19. März 2003 (19.03.2003) DE

(71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von US): CONSOLID TECHNIK DEUTSCHLAND GMBH [DE/DE]; Schwanheimer Strasse 144a, 64625

[Fortsetzung auf der nächsten Seite]

(54) Title: MEANS AND METHOD FOR SEALING CONSTRUCTIONS

(54) Bezeichnung: MITTEL UND VERFAHREN ZUM ABDICHTEN VON BAUWERKEN



**WO 2004/083532 A1**

(57) Abstract: The invention relates to a means and a method for sealing constructions. The aim of the invention is to provide a means and a method for sealing constructions, which enable novel and already existing constructions to be permanently sealed in a flexible, high-quality and economical manner, by introducing a core sealing element. To this end, the means for sealing constructions consists of a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive which breaks open the water surrounding the grain. According to the inventive method, the mixture of soil and additive is sprayed into the construction or over the surface thereof.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft ein Mittel und ein Verfahren zum Abdichten von Bauwerken. Um ein Mittel und ein Verfahren zum Abdichten von Bauwerken zur Verfügung zu stellen, welche eine flexible, hochgradig dichte, preiswerte und dauerhafte zur Abdichtung von neuen und bereits bestehenden Bauwerken durch Einbringen einer Kernabdichtung ermöglicht, wird erfindungsgemäß vorgeschlagen, daß das Mittel zum Abdichten von Bauwerken aus einem Gemisch aus Erdstoff, vorzugsweise tonigen Materialien und/oder Schluff, und einem das Hüllwasser um das Korn aufbrechenden Zusatzstoff besteht. Hinsichtlich des Verfahrens wird vorgeschlagen, daß das Gemisch aus Erdstoff und einem Zusatzstoff in das Bauwerk eingespritzt oder oberflächlich aufgespritzt wird.

## Mittel und Verfahren zum Abdichten von Bauwerken

---

Die Erfindung betrifft ein Mittel und Verfahren zum Abdichten von Bauwerken, insbesondere Erdbauwerken.

Aus dem Stand der Technik sind Mittel und Verfahren zum Abdichten von Bauwerken, beispielsweise Dämmen und Deichen, bekannt, die Beton, zum Beispiel WU-Beton, als Dichtmittel verwenden. Der wasserundurchlässige Beton kann durch Schlitzwände oder Spundbohrungen in bereits bestehende Deiche eingebracht werden. Diese Vorgehensweise ist jedoch gerade bei Deichen nachteilig, da ein starrer Körper innerhalb des Deiches gebildet wird, der Baugrundverschiebungen nicht kompensieren kann, so daß es zu Brüchen und Rissen in der Betonabdichtung kommen kann. Risse in der Abdichtung führen jedoch dazu, daß der Deich oder im allgemeinen das Bauwerk wieder wasserundurchlässig wird und die Gefahr der Unterspülung besteht.

Dem gegenüber bietet der Einsatz von tonigen Mischungen zum Abdichten von Bauwerken, früher als „Lehmschlag“ bekannt, den Vorteil, daß diese Art der Abdichtung keinen starren Dichtungskörper bildet, so daß Baugrundverschiebungen kompensiert werden und keine Undichtigkeiten auftreten können. Abdichtungen von Bauwerken aus tonigen Mischungen haben eine in etwa gleich hohe Wasserundurchlässigkeit wie Abdichtungen mit Hilfe von Beton. Lehmschläge auf der Dammaußenseite sind außerdem relativ aufwendig, erfordern viel Baumaterial, zerstören das Biotop auf der Dammoberfläche und haben keine besonders hohen Lebensdauern. Sie sind außerdem auf die Verwendung bei Dämmen oder Deichen beschränkt, die zumindest während der Bauphase trocken liegen können.

Gegenüber dem Stand der Technik liegt der Erfindung die Aufgabe zugrunde, ein Mittel und ein Verfahren zum Abdichten von Bauwerken zur Verfügung zu stellen, welche eine flexible, hochgradig dichte, preiswerte und dauerhafte zur Abdichtung von neuen und bereits bestehenden Bauwerken durch Einbringen einer Kernabdichtung ermöglicht.

Die Aufgabe wird dadurch gelöst, daß das Mittel zum Abdichten von Bauwerken aus einem Gemisch aus tonigen Materialien und einem das Hülbwasser um das Korn des Erdstoffs aufbrechenden Zusatzstoff besteht, wobei 1 m<sup>3</sup> Erdstoff bis zu bis zu 0,5 Vol.-%, vorzugsweise zwischen 0,01 Vol.-% und 0,1 Vol.-% und besonders bevorzugt 0,03 Vol.-% des Zusatzstoffes

enthält. Gegenüber den herkömmlichen tonigen Mischungen, wie z.B. Betonit, zeigt dieses modifizierte Erdstoffgemisch eine wesentlich verbesserte Abdichtung, wobei die flexiblen Eigenschaften der tonigen Mischungen aus dem Stand der Technik erhalten bleiben. Bei dem erfindungsgemäßen Mengenverhältnis zwischen Zusatzstoff und Erdstoff wird eine optimale Wasserundurchlässigkeit erreicht. Dabei sollte die Konzentration des Zusatzstoffes 0,5 Vol.-% nicht wesentlich übersteigen, da bei höheren Konzentrationen der Zusatzstoff filmbildend um den Erdstoff wirkt.

Das Einbringen des erfindungsgemäßen Zusatzstoffes in das Erdstoffgemisch führt offenbar durch Aufbrechen der das einzelne Korn im allgemeinen umgebenden Wasserhülle zu einer besseren Koagulation aufgrund der stärkeren Adhäsionskräfte, mit denen die einzelnen Partikel des Erdstoffes nach dem Aufbrechen ihrer Wasserhülle aneinander haften können. Durch Verwendung des Zusatzstoffes in der bevorzugten Ausführungsform der Erfindung führt dies dazu, dass das Gemisch eine kompakte, zähplastische und wasserundurchlässige Konsistenz erhält. Auch nach einem zwangswiseen Austrocknen bleibt das Gemisch stabil und nimmt bei Aufnahme einer geringen Wassermenge sofort wieder die zähplastische, wasserundurchlässige Konsistenz an. Aufgrund der starken Kohäsion zwischen den Körnern kann die Abdichtung weder durchwurzelt werden, noch von Kleingetier befallen werden. Darüberhinaus sind jederzeit Anschlußarbeiten möglich, da das Gemisch nicht abbindet. Ein Auskolken des Injektionskörpers bei strömendem Wasser findet nicht statt.

In einer bevorzugten Ausführungsform ist der Zusatzstoff ein Polymer, insbesondere ein polymeres (Meth)Acrylamid. Bei der Verwendung von polymeren Zusatzstoffen werden K-Werte um  $10^{-8}$  m/Sekunde erreicht. Eine mögliche Erklärung für das Erreichen der hohen K-Werte könnte die dichte Lagerung der Erdstoffbestandteile und das Ausfüllen der Poren im Gefüge durch die Tonpartikel sein.

Besonders bevorzugt wird darüber hinaus eine Ausführungsform der Erfindung, bei der der Zusatzstoff verselzte Paraffine enthält. Die Verwendung des polymeren (Meth)Acrylamids in Verbindung mit verselzten Paraffinen ist ökologisch unbedenklich, so daß das Mittel zum Abdichten in allen Grundwasserzonen verwendet werden kann. Eine Bindemittelfunktion ist aufgrund der geringen Konzentration des Zusatzstoffes nicht möglich und gewünscht und erfolgt auch nicht durch etwaige Zement oder Kalkbeimengungen, deren Konzentration hierfür ebenfalls zu gering wäre. Es findet keine chemische Reaktion mit dem Zusatzstoff statt, sondern dieser wirkt im wesentlichen hydrophobierend auf das Korn. Seine Wirkung ist vergleichbar mit der eines Katalysators.

Es ist zweckmäßig, wenn der Erdstoff in der vorliegenden Erfindung Ton und/oder Schluff enthält. Als besonders vorteilhaft hat sich ein Anteil von mindestens 10 Gew.-%, vorzugsweise

mindestens 15 Gew.-% Ton und/oder Schluff in dem Erdstoff herausgestellt. Gerade die feinkörnigen Bestandteile wie Ton oder Schluff des Erdstoffs ermöglichen in Verbindung mit dem Zusatzstoff die Bildung einer kompakten, zähplastischen und wasserundurchlässigen Masse.

In einer bevorzugten Ausführungsform der Erfindung ist dem Gemisch ein Anteil Zement und/oder Kalk, welcher seinerseits einen Anteil von 1 Gew.-% bis 10 Gew.-%, vorzugsweise 3,5 Gew.-% des Zusatzstoffes enthält, beigemengt. Diese Beimengung ist vorteilhaft, da sie den Zusatzstoff verdünnt und beispielsweise die gleichmäßige Verteilung des Zusatzstoffes beim Einspritzen des Gemisches in ein bereits bestehendes Bauwerk erleichtert. Besonders bevorzugt wird dabei eine Ausführungsform der Erfindung, bei der einem Kubikmeter Erdstoff zwischen 15 kg und 25 kg, vorzugsweise 20 kg des den Zusatzstoff enthaltenden Zements oder Kalks beigemengt ist. Diese Menge ermöglicht eine optimale Verdünnung des Zusatzstoffes bei der Injektion in ein bestehendes Bauwerk. Die Vermengung von Zusatzstoff und Zement und/oder Kalk kann werkseitig, d.h. nicht auf der Baustelle, erfolgen.

Um das Gemisch fließfähig zu machen ist es zweckmäßig, wenn dem Gemisch ein Anteil zwischen 20 Gew.-% und 50 Gew.-%, vorzugsweise zwischen 25 Gew.-% und 40 Gew.-% und besonders bevorzugt zwischen 30 Gew.-% und 35 Gew.-% an Wasser beigemengt ist. Bei diesem Wassergehalt besitzt das Gemisch thixotrope Eigenschaften, d.h. das Material lässt sich pumpen und fördern, wird jedoch geleeartig fest, sobald es zur Ruhe kommt. Nach dem Auströten des überschüssigen Wassers wird die Procordichte des Gemisches erreicht, d.h. bei diesem Wassergehalt wird eine optimale Verdichtung des Erdstoffs und des Zusatzstoffes erreicht.

Hinsichtlich des Verfahrens wird die der Erfindung zugrunde liegende Aufgabe dadurch gelöst, daß ein Gemisch aus Erdstoff und einem Zusatzstoff, so wie er zuvor beschrieben wurde, in ein Bauwerk eingespritzt oder oberflächlich im Naßstromverfahren aufgespritzt wird. Diese Vorgehensweise ermöglicht es, ein bereits bestehendes Bauwerk nachträglich, also auch Jahre nach seiner Erbauung, abzudichten.

In einer bevorzugten Ausführungsform der Erfindung werden zunächst in das Bauwerk Löcher gebohrt, deren Wände stabilisiert werden. Anschließend wird der Erdstoff aus den Wänden der Löcher herausgespült und ein Gemisch aus Erdstoff und einem Zusatzstoff, so wie er zuvor beschrieben wurde, in das Loch eingepreßt. Dieses Verfahren ermöglicht es, den Zusatzstoff auch in Bauwerke einzubringen, deren Erdstoff bereits derart stark verfestigt ist, daß der Zusatzstoff nicht durch Hohlräume und/oder poröse Zwischenräume des Erdstoffs eingebracht werden kann.

In einer besonders bevorzugten Ausführungsform werden die Wände der Bohrlöcher mit einem Rohr, das Schlitze aufweist, abgestützt und der Erdstoff durch die Schlitze ausgespült und das Gemisch aus Erdstoff und einem Zusatzstoff, so wie er zuvor beschrieben wurde, durch dieselben oder andere, benachbarte Schlitze oder Öffnungen in das Bauwerk eingepreßt. Das Abstützen der Bohrlöcher mit einem Schlitzrohr verhindert, daß die Wände der Bohrlöcher während der Arbeiten einfallen und so das Einbringen der Abdichtung in das Bauwerk behindert. Dabei verbleibt das Schlitzrohr vorteilhafterweise während aller Abschnitte in dem Bohrloch.

In einer besonders bevorzugten Ausführungsform des erfindungsgemäßen Verfahrens erfolgt das Ausspülen des Erdstoffs sowie das Einbringen des Gemisches aus Erdstoff und Zusatzstoff in einem Arbeitsgang.

In Abhängigkeit von der Baugrundzusammensetzung kann es zweckmäßig sein, wenn dem Gemisch aus Erdstoff und einem einem Zusatzstoff, so wie er zuvor beschrieben wurde, zusätzlich Stoffe mit einem hohen Feinanteil, vorzugsweise Ton und/oder Schluff, zugesetzt werden. Dies ermöglicht es, auch Bauwerke, deren Erdstoff nur geringe Feinanteile enthält, mit dem zuvor genannten Verfahren nachträglich sehr wirksam abzudichten.

Alternativ zu dem genannten Verfahren kann es bei injektionsfähigen Böden vorteilhaft sein, den zuvor beschriebenen Zusatzstoff in Hohlräume, Löcher und/oder in die porösen Zwischenräume des Erdstoffes des Bauwerks direkt zu injizieren, so daß er sich dort mit dem Erdstoff vermischt. Dieses Verfahren ermöglicht die Einbringung des Zusatzstoffes in das Bauwerk mit geringem Aufwand.

In einer bevorzugten Ausführungsform der Erfindung werden rotierende Bohrlanzen zum Einspritzen der Gemisches aus Erdstoff und einem Zusatzstoff verwendet, um mit einem definierten Injektionsdruck einen zylindrischen Körper aus Abdichtungsmaterial in dem Bauwerk aufzubauen.

Weitere Vorteile, Merkmale und Anwendungsmöglichkeiten der vorliegenden Erfindung werden anhand der folgenden Beschreibung einer bevorzugten Ausführungsform und der dazugehörigen Figuren deutlich. Es gelgen:

- Figur 1 eine schematische Darstellung des Austauschprozesses von Erdstoff,
- Figur 2 eine schematische Darstellung der Injektion eines Gemisches aus Erdstoff und Zusatzstoff in ein Bohrloch,
- Figur 3a-c eine schematische Darstellung des schrittweisen Vorgehens beim Injizieren des Gemisches aus Erdstoff und einem Zusatzstoff in ein Bohrloch,
- Figur 4 eine seitliche Schnittansicht durch einen Flußdeich mit Bohrlöchern,

Figur 5 eine schematische Schnittansicht eines Tiefbauwerks mit Flächenabdichtung,  
Figur 6 eine schematische Schnittdarstellung eines Tunnelbauwerks mit verschiedenen  
Abdichtungen, und  
Figur 7 eine Schnittansicht eines Deiches mit Vertikalabdichtung.

In Figur 1 wird schematisch der Austausch des Erdstoffs 1 durch ein Gemisch aus dem zuvor entnommenen Erdstoff 1 und einem Zusatzstoff 3 gezeigt. In der gezeigten Ausführungsform wird als Zusatzstoff ein polymeres Acrylamid in Verbindung mit verseiften Paraffinen verwendet. Dieser Zusatzstoff ist unter dem Handelsnamen Consolid erhältlich. In ein Schlitzrohr 4 wird Wasser unter Hochdruck durch eine Rohrleitung 5 eingeleitet, so daß der Erdstoff an den Schlitten 6 des Rohres ausgespült wird. Das Gemisch aus Erdstoff und Wasser wird dann über eine Rohrleitung 7 aus dem Schlitzrohr 4 abgesaugt. Nach dem Absetzen in einem Absetzbecken 8 wird das Gemisch aus Erdstoff und Wasser in einem Mischwerk 9 mit Teilen des Bohrguts 10 und dem Zusatzstoff 3 vermischt. Gegebenenfalls kann im Mischwerk Erdstoff mit einem höheren Feinanteil, zum Beispiel Schluff und/oder Ton, belgemischt werden. Das modifizierte Tongemisch 2 wird dann über eine weitere Leitung 12 zurück in einen Bereich 13 unter der Entnahmestelle des Schlitzrohres 4 mit Druck eingebracht. Dort wird er zum Verfüllen der Wandbereich 6, aus denen zuvor Erdstoff 1 ausgespült wurde, verwendet. In einem abschließenden Arbeitsgang wird das Schlitzrohr 4 aus dem Bohrloch gezogen und das Bohrloch mit dem modifizierten Tongemisch 2 verfüllt.

Figur 2 zeigt schematisch das Injizieren des modifizierten Tongemisches mit einem Zusatzstoff, hier Consolid, und eventuell zusätzlichen Feinanteilen in ein Bohrloch 4. Dazu wird mit einer rotierenden Bohrlanze 14 ein Loch 4 gebohrt und gleichzeitig das modifizierte Tongemisch 2 eingepreßt.

Besonders deutlich ist dies in den Figuren 3a - c zu erkennen. In Figuren 3a und b sieht man wie während des Bohrens mit der Bohrlanze 14 das modifizierte Tongemisch in das Bohrloch eingepreßt wird. Dabei ist zu erkennen, wie das modifizierte Tongemisch 2 auch in den unmittelbar an das Bohrloch 4 anschließenden Bereichen 15 in den Erdstoff 1 eindringt.

In Figur 3c sind zwei nebeneinanderliegende, bereits mit dem modifizierten Tongemisch 2 verfüllte Bohrlöcher 4 gezeigt. Ihre Rand- bzw. Umgebungsbereiche 15, die ebenfalls von dem modifizierten Tongemisch durchdrungen sind, überlappen sich in einem Bereich 16, so daß sich im Querschnitt eine durchgängige Dichtfläche, gebildet aus dem modifizierten Tongemisch, ergibt.

Figur 4 zeigt die Bildung einer durchgängigen Dichtfläche innerhalb eines Flussdeiches besonders deutlich. Durch die Wahl der Anordnung der Bohrlöcher 4 ergeben sich jeweils überlappende,

von dem Abdichtungsgemisch durchsetzte Umgebungsberäiche 16 der Bohrlöcher, so daß eine unterbrechungsfreie Abdichtung eines bereits bestehenden Deiches aufgebaut werden kann, ohne den Deich in seiner gesamten Länge abgraben zu müssen.

Figur 5 zeigt ein Tiefbauwerk, dessen Bodenfläche 18 mit zwei Dichtflächen 19 aus dem modifizierten Tongemisch 2 abgedichtet wurden.

Figur 6 zeigt einen Tunnel, dessen Rückenfläche 20 im oberen Bereich mit einer Abdichtung 20 aus dem modifizierten Tongemisch 2 versehen wurde. Darüber hinaus ist auch eine Abdichtung 22 aus modifiziertem Tongemisch 2 zu sehen, die den Bereich der Tunnelröhre und des benachbarten Erdreiches abdeckt. Solche Abdeckungen werden häufig im Bereich des U-Bahnbau verwendet, bei dem über der Tunnelröhre weitere Verkehrsflächen angeordnet sind. Eine weitere Abdichtung 23 im Bereich seitlich der Tunnelröhre 24 kann zum Beispiel das Eindringen von Grundwasser in die Tunnelröhre 24 verhindern.

Figur 7 zeigt eine sogenannte Vertikalabdichtung 20 eines Deiches 17. Dazu werden senkrecht zur Deichkrone Schlitze in den Deich gegraben, in diesem Fall zwei, die mit dem modifizierten Tongemisch 2 zur Abdichtung des Deiches 17 verfüllt werden.

**Patentansprüche**

1. Mittel zum Abdichten von Bauwerken, das aus einem Gemisch aus Erdstoff, vorzugsweise tonigen Materialien und/oder Schluff, und einem das Hohlwasser um das Korn aufbrechenden Zusatzstoff besteht, wobei 1 m<sup>3</sup> Erdstoff bis zu 0,5 Vol.-%, vorzugsweise zwischen 0,01 Vol.-% und 0,1 Vol.-% und besonders bevorzugt 0,03 Vol.-% des Zusatzstoffes enthält.
2. Mittel zum Abdichten von Bauwerken nach Anspruch 1, dadurch gekennzeichnet, daß der Zusatzstoff ein Polymer, insbesondere ein polymeres (Meth)Acrylamid ist.
3. Mittel zum Abdichten von Bauwerken nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Zusatzstoff verseifte Paraffine enthält.
4. Mittel zum Abdichten von Bauwerken nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Erdstoff einen Anteil von mindestens 10 Gew.-%, vorzugsweise mindestens 15 Gew.-% Ton und/oder Schluff enthält.
5. Mittel zum Abdichten von Bauwerken nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß dem Gemisch ein Anteil Zement und/oder Kalk, welcher seinerseits einen Anteil von 1 Gew.-% bis 10 Gew.-%, vorzugsweise 3,5 Gew.-% des Zusatzstoffes enthält, beigemengt ist.
6. Mittel zum Abdichten von Bauwerken nach Anspruch 5, dadurch gekennzeichnet, daß 1 m<sup>3</sup> Erdstoff zwischen 15 kg und 25 kg, vorzugsweise 20 kg des den Zusatzstoff enthaltenden Zements oder Kalkes beigemengt ist.
7. Mittel zum Abdichten von Bauwerken nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß dem Gemisch zur Herstellung seiner Fließfähigkeit ein Anteil zwischen 20 Gew.-% und 50 Gew.-%, vorzugsweise zwischen 20 Gew.-% und 40 Gew.-% und besonders bevorzugt zwischen 30 Gew.-% und 35 Gew.-% an Wasser beigemengt ist.
8. Verfahren zum Abdichten von Bauwerken bei dem ein Gemisch aus Erdstoff und einem Zusatzstoff nach einem der Ansprüche 1 bis 7 in das Bauwerk eingespritzt oder oberflächlich aufgespritzt wird.
9. Verfahren zum Abdichten von Bauwerken nach Anspruch 8, dadurch gekennzeichnet, daß in das Bauwerk Löcher gebohrt werden, deren Wände stabilisiert werden, daß der

Erdstoff aus den Wänden der Löcher herausgespült wird und anschließend ein Gemisch aus Erdstoff und einem Zusatzstoff nach einem der Ansprüche 1 bis 7 in das Loch eingepreßt wird.

10. Verfahren zum Abdichten von Bauwerken nach Anspruch 9, dadurch gekennzeichnet, daß die Wände der Bohrlöcher mit einem Rohr, das Schlitze aufweist, abgestützt werden und der Erdstoff durch die Schlitze ausgespült wird und das Gemisch aus Erdstoff und einem Zusatzstoff nach einem der Ansprüche 1 bis 7 durch die Schlitze in das Bauwerk eingepreßt wird.
11. Verfahren zum Abdichten von Bauwerken nach einem der Ansprüche 8 bis 10, dadurch gekennzeichnet, daß dem Gemisch aus dem Erdstoff und einem Zusatzstoff nach einem der Ansprüche 1 bis 6, Stoffe mit einem hohen Feinanteil, vorzugsweise Ton und/oder Schluff, zugesetzt werden.
12. Verfahren zum Abdichten von Bauwerken, bei dem ein Zusatzstoff nach einem der Ansprüche 1 bis 7 in Hohlräume, Löcher und/oder in die porösen Zwischenräume des Erdstoffes des Bauwerks injiziert wird und dort mit dem Erdstoff vermischt wird.
13. Verfahren nach einem der Ansprüche 8 oder 12, dadurch gekennzeichnet, daß der Zusatzstoff oder das Gemisch aus Erdstoff und Zusatzstoff über eine rotierende Bohrlanze in das Bauwerk eingespritzt wird.

Fig. 1

1/3

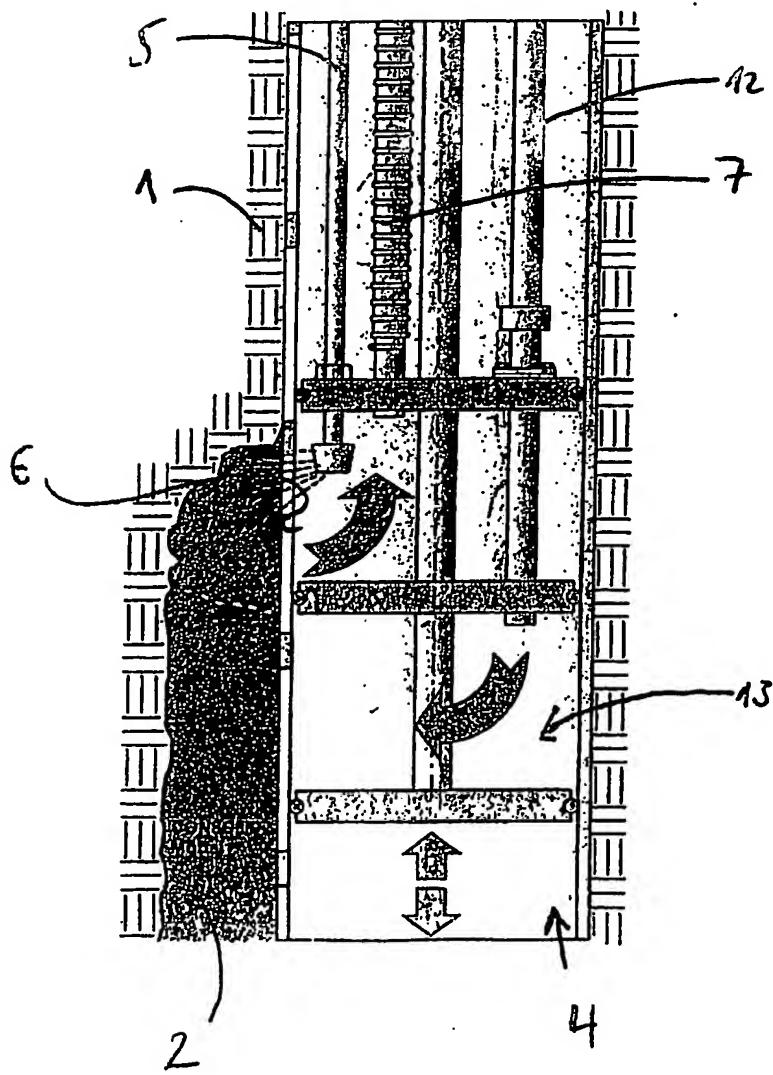
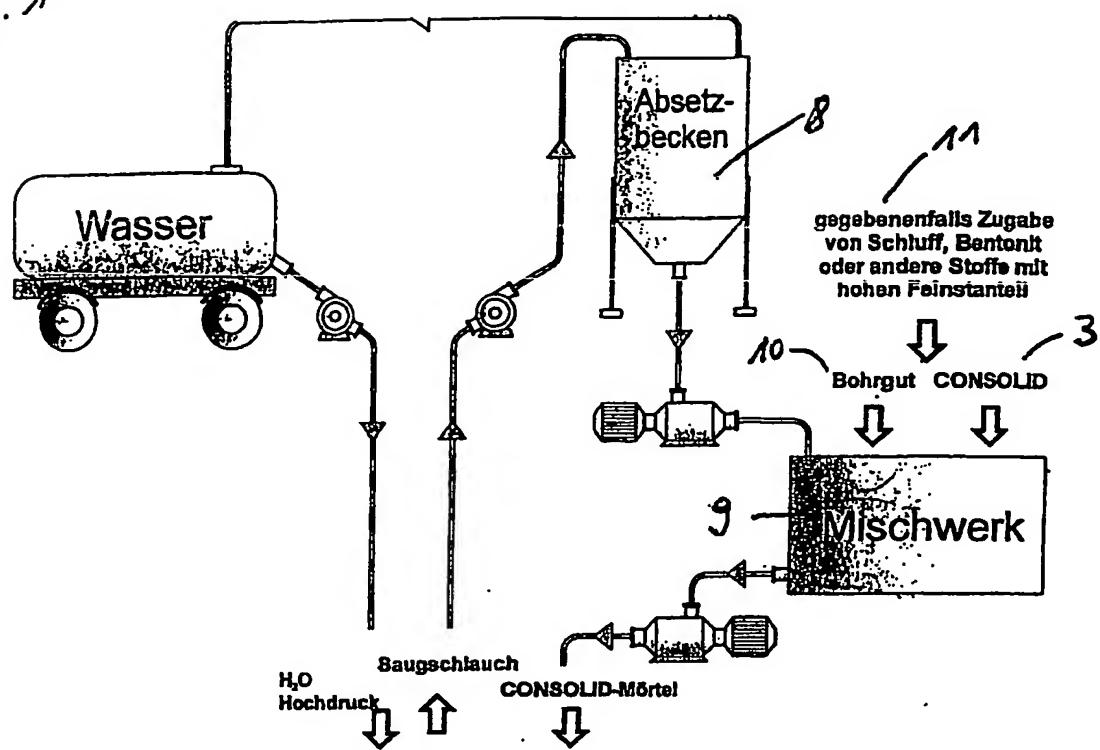


Fig 2

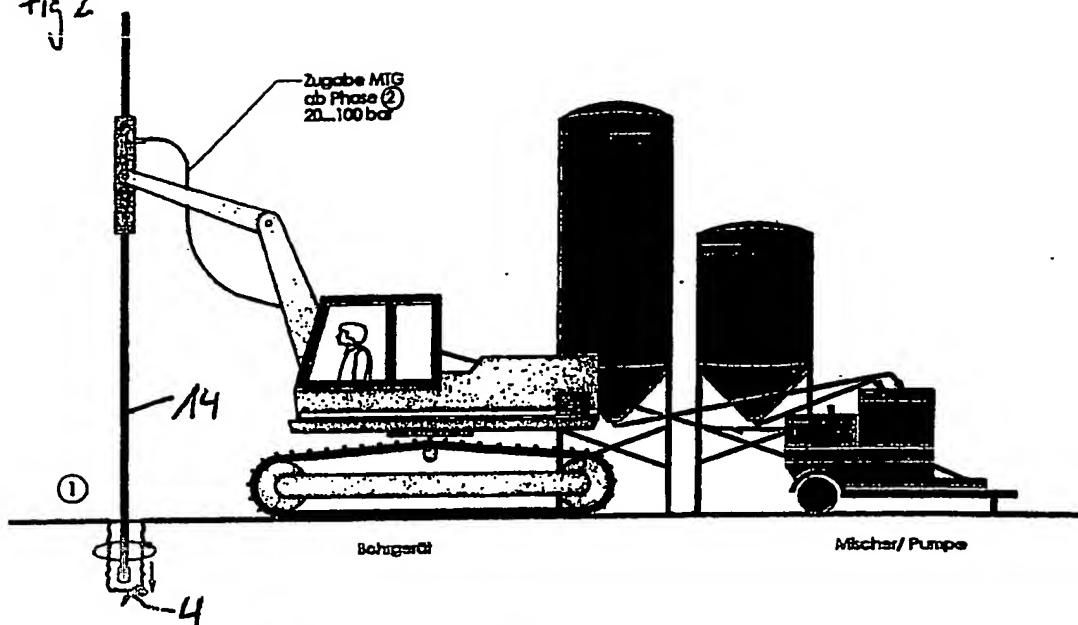


Fig 3

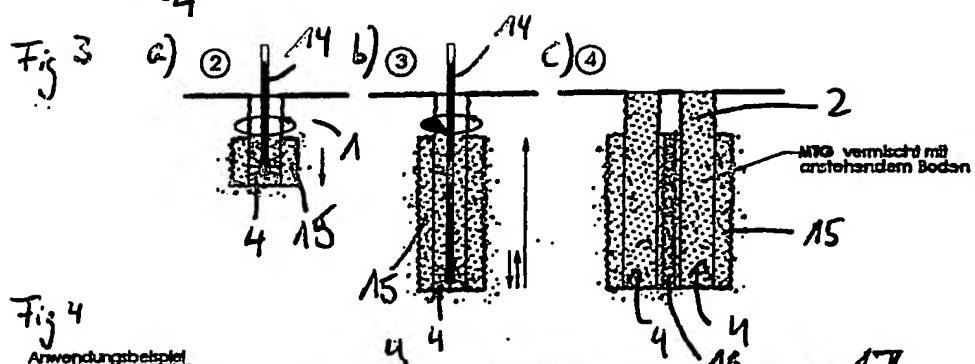


Fig 4

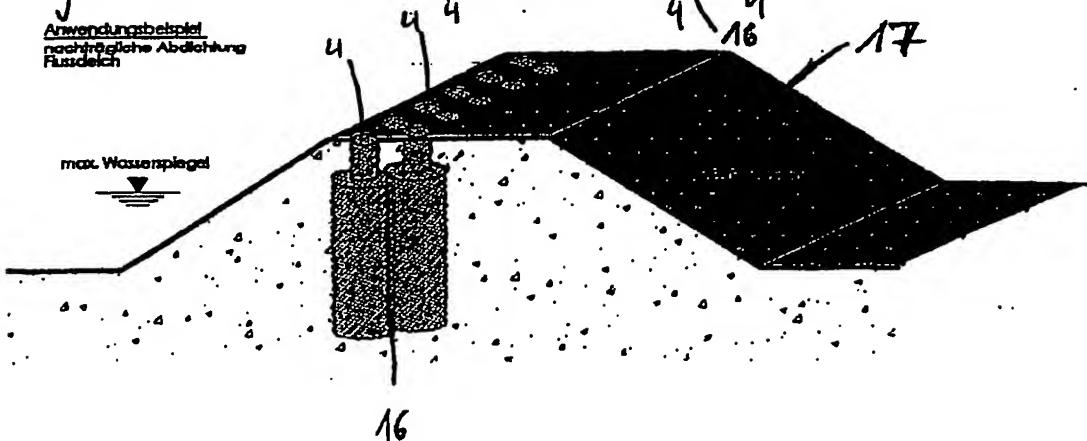


Fig. 5

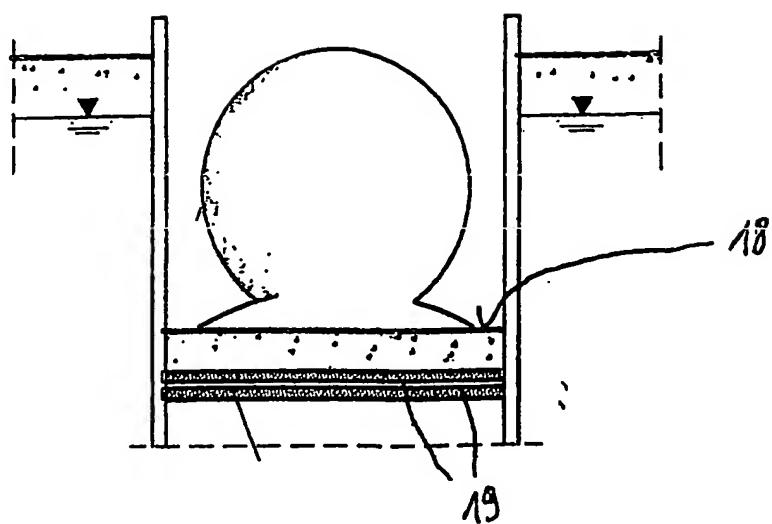


Fig. 6

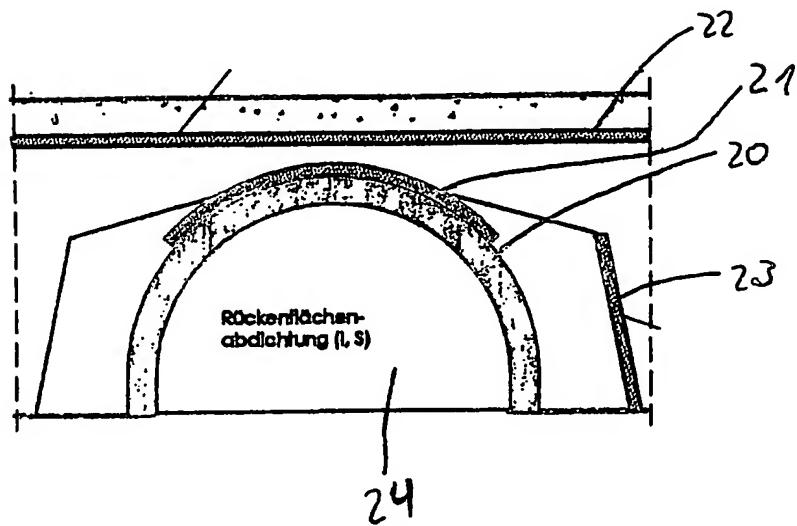
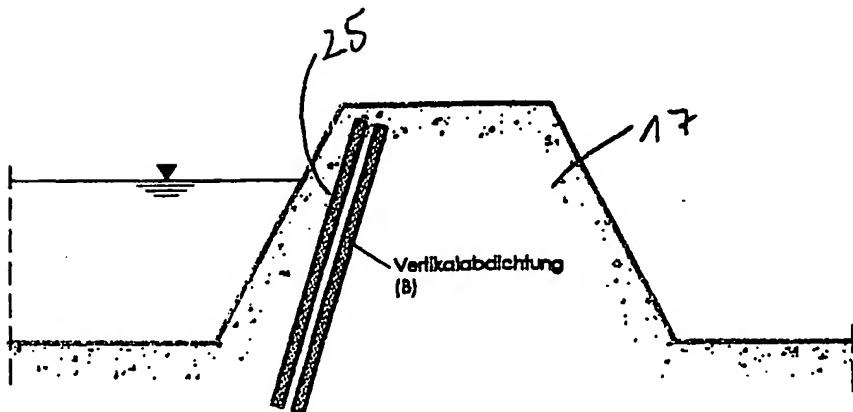


Fig. 7



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/DE2004/000528

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 E02D3/12 C09K17/00 C09K3/10 C04B26/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 E02D C09K C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GIURGEA V. I.: "Hydrogeologische und geotechnische Voraussetzungen für die Anlage von Standorten zur Lagerung radioaktiver Reststoffe unter Berücksichtigung des Consolid-System" 1999, PROF. DR. KURT CZURDA UND PROF. DR. HEINZ HÖTZL, LEHRSTUHL FÜR ANGEWANDTE GEOLOGIE DER UNIVERSITÄT KARLSRUHE, KARLSRUHE, XP002289135 pages 23-34	1-13
X	EP 1 155 732 A (REATEC GMBH) 21 November 2001 (2001-11-21) column 2, line 48 - column 3, line 1	1-13

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

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- \*&\* document member of the same patent family

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1155732	A 21-11-2001 EP	1155732 A1	21-11-2001

# INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen  
PCT/DE2004/000528

<b>A. KLASIFIZIERUNG DES ANMELDUNGSGEGENSTANDES</b> IPK 7 E02D3/12 C09K17/00 C09K3/10 C04B26/02			
Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK			
<b>B. RECHERCHIERTE GEBIETE</b> Recherchierte Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole) IPK 7 E02D C09K C04B			
Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen			
Während der Internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe) <b>EPO-Internal, WPI Data, PAJ, CHEM ABS Data</b>			
<b>C. ALS WESENTLICH ANGESEHENE UNTERLAGEN</b>			
Kategorie* Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile		Betr. Anspruch Nr.	
X	GIURGEA V. I.: "Hydrogeologische und geotechnische Voraussetzungen für die Anlage von Standorten zur Lagerung radioaktiver Reststoffe unter Berücksichtigung des Consolid-System" 1999, PROF. DR. KURT CZURDA UND PROF. DR. HEINZ HÖTZL, LEHRSTUHL FÜR ANGEWANDTE GEOLOGIE DER UNIVERSITÄT KARLSRUHE, KARLSRUHE, XP002289135 Seiten 23-34	1-13	
	EP 1 155 732 A (REATEC GMBH) 21. November 2001 (2001-11-21) Spalte 2, Zeile 48 – Spalte 3, Zeile 1	1-13	
<input type="checkbox"/> Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen		<input checked="" type="checkbox"/> Siehe Anhang Patentfamilie	
* Besondere Kategorien von angegebenen Veröffentlichungen : "A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist "E" Älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldeatum veröffentlicht worden ist "L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt) "O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht "P" Veröffentlichung, die vor dem internationalen Anmeldeatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist			
Datum des Abschlusses der Internationalen Recherche <b>20. Juli 2004</b>		Absendedatum des Internationalen Recherchenberichts <b>05/08/2004</b>	
Name und Postanschrift der Internationalen Recherchenbehörde Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 91 651 epo nl, Fax (+31-70) 340-3016		Bevollmächtigter Bediensteter <b>Pollito, M</b>	

**INTERNATIONALER RECHERCHENBERICHT**

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen

**PCT/DE2004/000528**

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
EP 1155732	A 21-11-2001 EP	1155732 A1	21-11-2001

## Means and method of sealing constructions

5 The invention concerns a means for and methods of sealing constructions, in particular earthwork constructions.

Means for and methods of sealing constructions, for example dams and dikes, which use concrete, for example water-impermeable concrete, as a sealing means, are known from the state of the art. The water-impermeable concrete can be introduced into 10 already existing dikes through slot walls or bung bores. That procedure is disadvantageous however precisely in relation to dikes as a rigid body is formed within the dike, which cannot compensate for shifts in the foundation soil so that breaks and cracks can occur in the concrete sealing means. Cracks in the sealing means however mean that the dike or generally the construction becomes water-permeable again and 15 there is the risk of underscouring.

In comparison the use of argillaceous mixtures for sealing constructions, earlier known as 'puddle', affords the advantage that this kind of sealing does not form a rigid sealing body so that shifts in foundation soil are compensated and no leaks can occur.

Sealing arrangements for constructions comprising argillaceous mixtures involve 20 water-impermeability of approximately the same level as sealing arrangements using concrete. Puddles on the dam outside are also relatively complicated and expensive, require a great deal of construction material, destroy the biotop on the dam surface and do not have particularly long service lives. They are also limited to use in relation to dams or dikes which can be dry at least during the building phase.

25 In comparison with the state of the art the object of the invention is to provide a means for and a method of sealing constructions, which permits new and already existing constructions to be flexibly, inexpensively and permanently sealed with a high degree of sealing integrity, by the introduction of a core sealing means.

That object is attained in that the means for sealing constructions comprises a 30 mixture of argillaceous materials and an additive which breaks open the enclosing water around the grain of the soil, wherein 1m<sup>3</sup> of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably

0.03% by volume of the additive. In comparison with the conventional argillaceous mixtures such as for example bentonite, that modified soil mixture exhibits a substantially improved sealing action, wherein the flexible properties of the argillaceous mixtures from the state of the art are still retained. The quantitative ratio 5 according to the invention between the additive and the soil achieves optimum water-impermeability. In that respect the concentration of the additive should not substantially exceed 0.5% by volume as, at higher levels of concentration, the additive has a film-forming effect around the soil.

Introduction of the additive according to the invention into the soil mixture, by 10 virtue of the water casing which generally surrounds the individual grain being broken open, obviously results in better coagulation by virtue of the stronger adhesion forces with which the individual particles of the soil can adhere to each other after their water casing has been broken open. By virtue of using the additive in the preferred embodiment of the invention, this provides that the mixture acquires a compact, 15 viscous-plastic and water-impermeable consistency. Even after a forced drying-out operation the mixture remains stable and upon absorbing a small amount of water immediately assumes again the viscous-plastic, water-impermeable consistency. Because of the strong cohesion between the grains, plant roots cannot pass through the sealing means, nor can it be infested by small animals. In addition adjunction works are 20 possible at any time as the mixture does not set. Undermining and erosion of the injection body in the case of flowing water does not occur.

In a preferred embodiment the additive is a polymer, in particular a polymeric (meth)acrylamide. When using polymeric additives K-values around  $10^9$  m/second are achieved. A possible explanation for achieving the high K-values could be the dense 25 bedding of the soil constituents and the fact that the pores in the structure are filled up by the clay particles.

In addition a particularly preferred embodiment of the invention is one in which the additive contains saponified paraffins. The use of the polymeric (meth)acrylamide in conjunction with saponified paraffins is ecologically harmless so that the sealing 30 means can be used in all ground water zones. Because of the low level of concentration of the additive a binding agent function is not possible and desired and is also not effected by any cement or lime admixtures, the concentration of which would also be

too low for that purpose. There is no chemical reaction with the additive, but it acts substantially with a hydrophobing effect on the grain. Its action is comparable to that of a catalyst.

It is desirable if the soil in the present invention contains clay and/or coarse 5 clay. A proportion of at least 10% by weight, preferably at least 15% by weight of clay and/or coarse clay has proven to be particularly advantageous. It is precisely the fine-grain constituents such as clay or coarse clay in the soil that, in conjunction with the additive, permit the formation of a compact, viscous-plastic and water-impermeable mass.

10 A preferred embodiment of the invention provides that a proportion of cement and/or lime which in turn contains a proportion of 1% by weight to 10% by weight, preferably 3.5% by weight of the additive, is added to the mixture. That addition is advantageous as it dilutes the additive and for example facilitates uniform distribution of the additive when injecting the mixture into an already existing construction. In that 15 respect a particularly preferred embodiment of the invention is one in which between 15 kg and 25 kg, preferably 20 kg of the cement or lime containing the additive, is added to one cubic metre of soil. That amount permits optimum dilution of the additive upon injection into an existing construction. Mixing of additive and cement and/or lime can take place at the factory, that is to say not on site.

20 In order to make the mixture capable of flow, it is desirable if a proportion of between 20% by weight and 50% by weight, preferably between 25% by weight and 40% by weight and particularly preferably between 30% by weight and 35% by weight of water is added to the mixture. With that water content the mixture has thixotropic properties, that is to say the material can be pumped and conveyed but becomes jelly-like firm as soon as it comes to rest. After the excess water issues the Proctor density of 25 the mixture is reached, that is to say with that water content, optimum compacting of the soil and the additive is achieved.

30 In regard to the method the object of the invention is achieved in that a mixture of soil and an additive, as has been described hereinbefore, is injected into a construction or is sprayed on at the surface using a wet flow method. That procedure makes it possible for an already existing construction to be sealed off subsequently, that is to say even years after it was constructed.

In a preferred embodiment of the invention firstly holes are bored into the construction, the hole walls being stabilised. The soil is then flushed out of the walls of the holes and a mixture of soil and an additive as has been described hereinbefore is pressed into the hole. That method makes it possible for the additive to be introduced 5 even into constructions whose soil is already so greatly compacted that the additive cannot be introduced through cavities and/or porous intermediate spaces in the soil.

In a particularly preferred embodiment the walls of the bore holes are supported with a tube which has slots and the soil is flushed out through the slots and the mixture of soil and an additive as has been described hereinbefore is pressed into the 10 construction through same or other adjacent slots or openings. Supporting the bore holes with a slotted tube prevents the walls of the bore holes falling in during the works and thus hindering the introduction of the sealing means into the construction. In that case the slotted tube advantageously remains in the bore hole during all stages.

In a particularly preferred embodiment of the method of the invention the 15 operation of flushing out the soil and the operation of introducing the mixture of soil and additive are effected in one working step.

Depending on the foundation soil composition it may be desirable if additional substances with a high fine proportion, preferably clay and/or coarse clay, are added to the mixture of soil and an additive as has been described hereinbefore. That makes it 20 possible for even constructions whose soil contains only small fine proportions to be subsequently very effectively sealed with the aforesaid method.

As an alternative to the specified method, in the case of injectable grounds, it may be advantageous for the above-described additive to be directly injected into cavities, holes and/or into the porous intermediate spaces of the soil of the construction 25 so that it mixes there with the soil. That method permits introduction of the additive into the construction with a low level of complication and expenditure.

In a preferred embodiment of the invention rotating boring lances are used for injection of the mixture of soil and an additive in order to build up a cylindrical body of sealing material in the construction, with a defined injection pressure.

30 Further advantages, features and possible uses of the present invention will be apparent from the description hereinafter of a preferred embodiment and the related Figures in which:

Figure 1 shows a diagrammatic representation of the soil exchange process,

Figure 2 shows a diagrammatic representation of the injection of mixture of soil and additive into a bore hole,

Figures 3a – c show diagrammatic representations of the stepwise procedure in  
5 the injection of the mixture of soil and an additive into a bore hole,

Figure 4 shows a lateral view in section through a river dike with bore holes,

Figure 5 shows a diagrammatic sectional view of a construction below ground level with surface sealing,

Figure 6 shows a diagrammatic sectional view of a tunnel construction with  
10 various sealing arrangements, and

Figure 7 shows a sectional view of a dike with vertical sealing.

Figure 1 diagrammatically shows the exchange of the soil 1 by a mixture of the previously removed soil 1 and an additive 3. In the illustrated embodiment the additive used is a polymeric acrylamide in conjunction with saponified paraffins. That additive  
15 can be obtained under the trade name Consolid. Water is introduced into a slotted tube 4 under high pressure through a conduit 5 so that the soil is flushed out at the slots 6 of the tube. The mixture of soil and water is then sucked away from the slotted tube 4 by way of a conduit 7. After settlement in a settlement tank 8 the mixture of soil and water is mixed in a mixer 9 with parts of the drilling material 10 and the additive 3. Soil can  
20 possibly be mixed in the mixer with a higher fine proportion, for example coarse clay and/or clay. The modified clay mixture is then passed by way of a further conduit 12 back into a region 13 under the removal location of the slotted tube 4, under pressure. There it is used for filling the wall region 6 from which soil 1 was previously flushed out. In a concluding working operation, the slotted tube 4 is drawn out of the bore hole  
25 and the bore hole is filled with the modified clay mixture 2.

Figure 2 diagrammatically shows the step of injecting the modified clay mixture with an additive, here Consolid, and optionally additional fine components, into a bore hole 4. For that purpose a hole 4 is bored with a rotating boring lance 14 and at the same time the modified clay mixture 2 is pressed thereinto.

30 That can be particularly clearly seen in Figures 3a – c. Figures 3a and b show how the modified clay mixture is pressed into the bore hole during the operation of boring the hole with the lance 14. It can be seen in this respect how the modified clay

mixture 2 also penetrates into the soil 1 in the regions 15 directly adjoining the bore hole 4.

Figure 3c shows two mutually juxtaposed bore holes 4 which are already filled with the modified clay mixture 2. Their edge or surrounding regions 15 which are also 5 penetrated by the modified clay mixture overlap in a region 16 so that in cross-section there is a continuous sealing surface formed from the modified clay mixture.

Figure 4 particularly clearly shows the formation of a continuous sealing surface within a river dike. The choice of the arrangement of the bore holes 4 provides 10 respective overlapping surrounding regions 6 around the bore holes, which are permeated by the sealing mixture, so that an interruption-free sealing arrangement in an already existing dike can be built up without having to excavate the dike over its entire length.

Figure 5 shows an underground construction, the bottom surface 18 of which has been sealed with two sealing surfaces 19 of the modified clay mixture 2.

15 Figure 6 shows a tunnel, the rear surface 20 of which has been provided in the upper region with a seal 20 of the modified clay mixture 2. In addition it is also possible to see a seal 22 of modified clay mixture 2, which covers over the region of the tunnel tubes and the adjacent earth. Such cover arrangements are frequently used in the field of underground railway construction in which further traffic levels are arranged 20 over the tunnel tubes. A further seal 23 in the region laterally of the tunnel tubes 24 can prevent for example ground water from penetrating into the tunnel tubes 24.

Figure 7 shows a so-called vertical seal 20 of a dike 17. For that purpose slots are excavated into the dike perpendicularly to the top thereof, in this case two slots, the slots being filled with the modified clay mixture 2 to seal off the dike 17.

CLAIMS

1. A means for sealing constructions comprising a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive which breaks open the enclosing water around the grain, wherein 1m<sup>3</sup> of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably 0.03% by volume of the additive.
2. A means for sealing constructions according to claim 1 characterised in that the additive is a polymer, in particular a polymeric (meth)acrylamide.
3. A means for sealing constructions according to claim 1 or claim 2 characterised in that the additive contains saponified paraffins.
4. A means for sealing constructions according to one of claims 1 to 3 characterised in that the soil contains a proportion of at least 10% by weight, preferably at least 15% by weight of clay and/or coarse clay
5. A means for sealing constructions according to one of claims 1 to 4 characterised in that a proportion of cement and/or lime which in turn contains a proportion of 1% by weight to 10% by weight, preferably 3.5% by weight of the additive, is added to the mixture.
6. A means for sealing constructions according to claim 5 characterised in that between 15 kg and 25 kg, preferably 20 kg of the cement or lime containing the additive, is added to 1 m<sup>3</sup> of soil.
7. A means for sealing constructions according to one of claims 1 to 6 characterised in that a proportion of between 20% by weight and 50% by weight, preferably between 20% by weight and 40% by weight and particularly preferably between 30% by weight and 35% by weight of water is added to the mixture to make it capable of flow.

8. A method of sealing constructions in which a mixture of soil and an additive according to one of claims 1 to 7 is injected into the construction or sprayed on at the surface.

9. A method of sealing constructions according to claim 8 characterised in that holes are bored into the construction, the walls of the holes being stabilised, that the soil is flushed out of the walls of the holes and then a mixture of soil and an additive according to one of claims 1 to 7 is pressed into the hole.

10. A method of sealing constructions according to claim 9 characterised in that the walls of the bore holes are supported with a tube which has slots and the soil is flushed out through the slots and the mixture of soil and an additive according to one of claims 1 to 7 is pressed into the construction through the slots.

11. A method of sealing constructions according to one of claims 8 to 10 characterised in that substances with a high fine proportion, preferably clay and/or coarse clay, are added to the mixture of the soil and an additive according to one of claims 1 to 6.

12. A method of sealing constructions wherein an additive according to one of claims 1 to 7 is injected into cavities, holes and/or into the porous intermediate spaces of the soil of the construction and there mixed with the soil.

13. A method according to one of claims 8 or 12 characterised in that the additive or the mixture of soil and additive is injected into the construction by way of a rotating boring lance.

## Abstract

The present invention relates to a means for and a method of sealing constructions. In order to provide a means for and a method of sealing constructions which permits flexible, inexpensive and permanent sealing of new and already existing constructions, with a high degree of sealing integrity, by introducing a core sealing means, it is proposed in accordance with the invention that the means for sealing constructions comprises a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive for breaking open the enclosing water around the grain. In regard to the method it is proposed that the mixture of soil and an additive is injected into the construction or is sprayed on at the surface.

Fig. 1

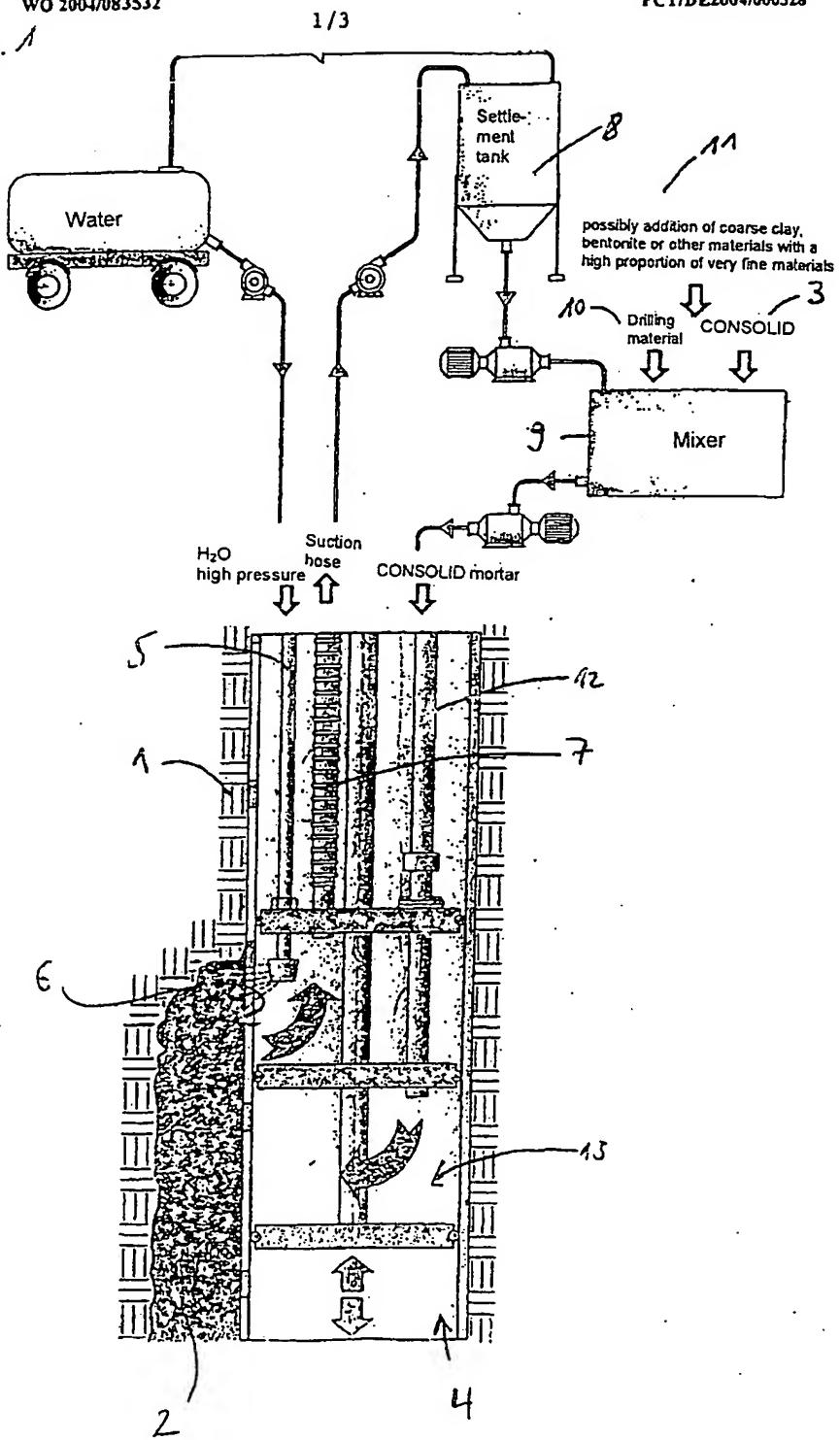


Fig 2

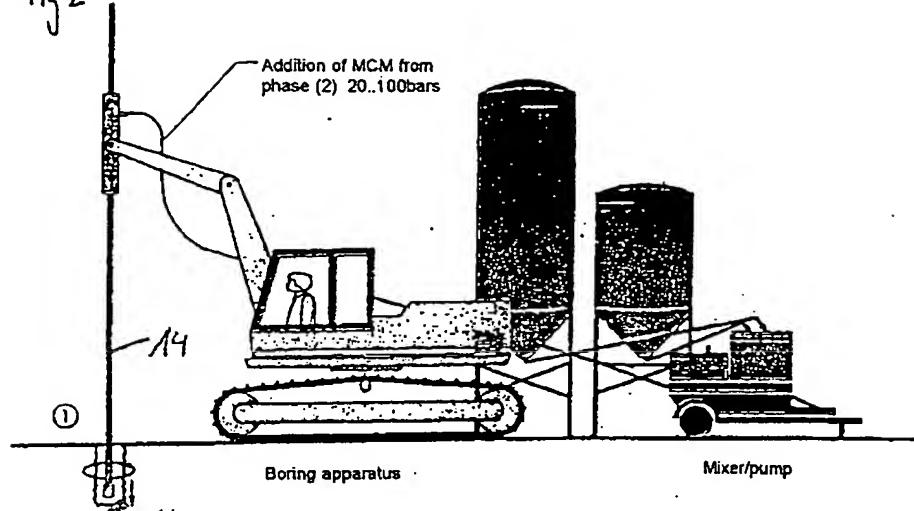


Fig 3

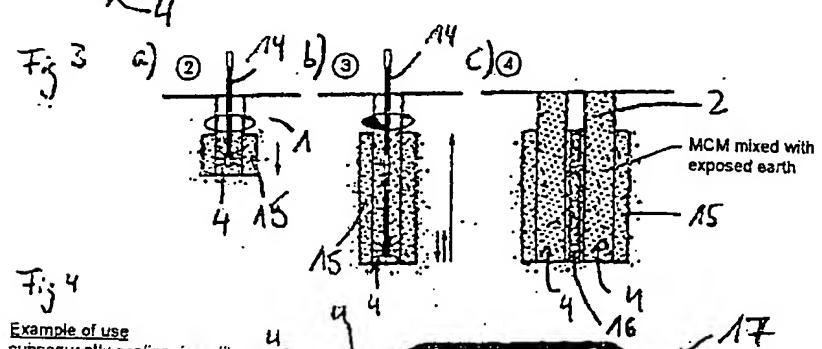
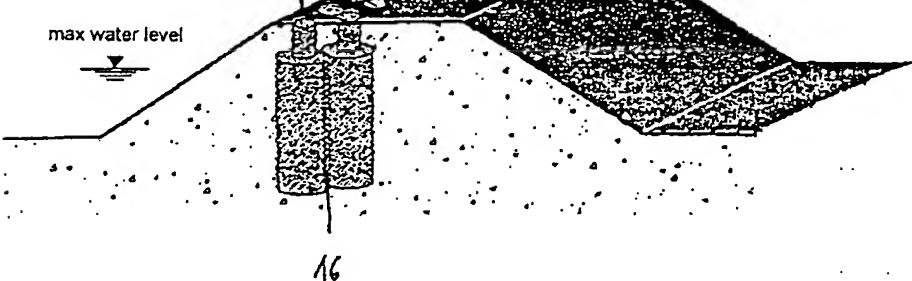


Fig 4

Example of use

subsequently sealing river dike



3/3

Fig. 5

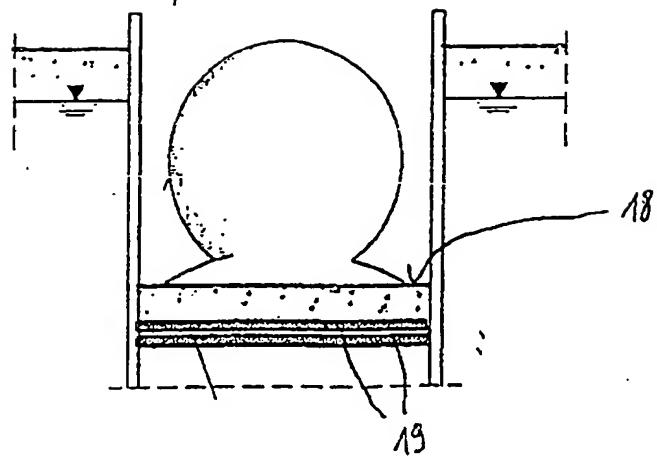


Fig. 6

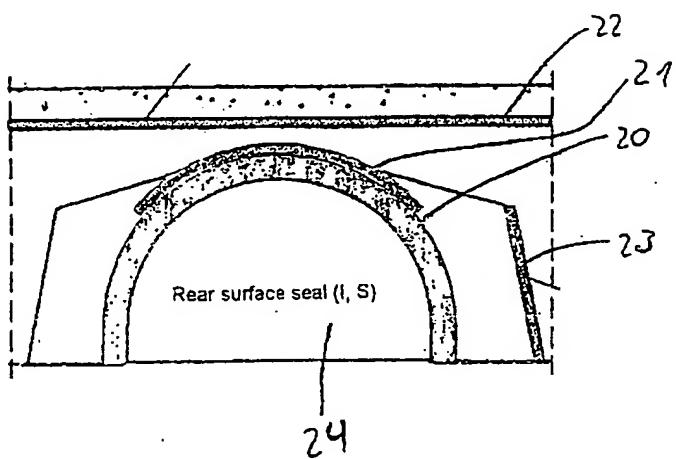
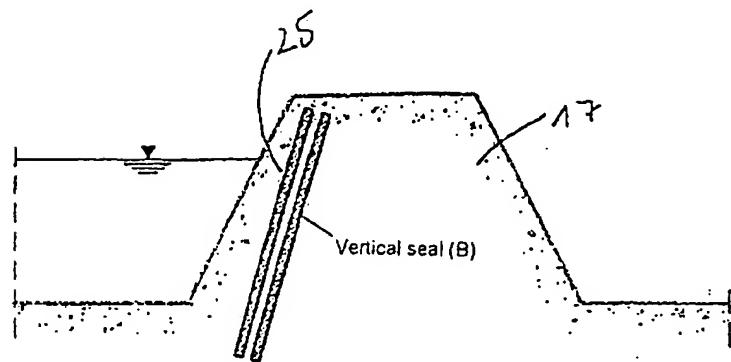


Fig. 7



PATENT COOPERATION TREATY

**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference #CONSOL103-01-WO	FOR FURTHER ACTION		See item 4 below
International application No. PCT/DE2004/000528	International filing date (day/month/year) 16 March 2004 (16.03.2004)	Priority date (day/month/year) 19 March 2003 (19.03.2003)	
International Patent Classification (IPC) or national classification and IPC 7 E02D 3/12, C09K 17/00, 3/10, C04B 26/02			
Applicant CONSOLID TECHNIK DEUTSCHLAND GMBH			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																								
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis.2).</p>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input checked="" type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application
<input checked="" type="checkbox"/>	Box No. I	Basis of the report																						
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<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																						
<input type="checkbox"/>	Box No. IV	Lack of unity of invention																						
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																						
<input type="checkbox"/>	Box No. VI	Certain documents cited																						
<input type="checkbox"/>	Box No. VII	Certain defects in the international application																						
<input checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application																						

		Date of issuance of this report 23 September 2005 (23.09.2005)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland		Authorized officer  Ellen Moyse
Facsimile No. +41 22 740 14 35		Telephone No. +41 22 338 89 75

# VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

Absender: INTERNATIONALE RECHERCHENBEHÖRDE

REC'D 03 AUG 2004

WIPO

PCT

An:

siehe Formular PCT/ISA/220

## SCHRIFTLICHER BESCHEID DER INTERNATIONALEN RECHERCHENBEHÖRDE (Regel 43bis.1 PCT)

Absendedatum  
(Tag/Monat/Jahr) siehe Formular PCT/ISA/210 (Blatt 2)

Aktenzeichen des Anmelders oder Anwalts  
siehe Formular PCT/ISA/220

**WEITERES VORGEHEN**  
siehe Punkt 2 unten

Internationales Aktenzeichen  
PCT/DE2004/000528

Internationales Anmelde datum (Tag/Monat/Jahr)  
16.03.2004

Prioritätsdatum (Tag/Monat/Jahr)  
19.03.2003

Internationale Patentklassifikation (IPK) oder nationale Klassifikation und IPK  
E02D3/12, C09K17/00, C09K3/10, C04B26/02

Anmelder  
CONSOLID TECHNIK DEUTSCHLAND GMBH

### 1. Dieser Bescheid enthält Angaben zu folgenden Punkten:

- Feld Nr. I Grundlage des Bescheids
- Feld Nr. II Priorität
- Feld Nr. III Keine Erstellung eines Gutachtens über Neuheit, erforderliche Tätigkeit und gewerbliche Anwendbarkeit
- Feld Nr. IV Mangelnde Einheitlichkeit der Erfindung
- Feld Nr. V Begründete Feststellung nach Regel 43bis.1(a)(i) hinsichtlich der Neuheit, der erforderlichen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung
- Feld Nr. VI Bestimmte angeführte Unterlagen
- Feld Nr. VII Bestimmte Mängel der internationalen Anmeldung
- Feld Nr. VIII Bestimmte Bemerkungen zur internationalen Anmeldung

### 2. WEITERES VORGEHEN

Wird ein Antrag auf internationale vorläufige Prüfung gestellt, so gilt dieser Bescheid als schriftlicher Bescheid der mit der internationalen vorläufigen Prüfung beauftragten Behörde ("IPEA"); dies trifft nicht zu, wenn der Anmelder eine andere Behörde als diese als IPEA wählt und die gewählte IPEA dem Internationalen Büro nach Regel 66.1bis b) mitgeteilt hat, daß schriftliche Bescheide dieser Internationalen Recherchenbehörde nicht anerkannt werden.

Wenn dieser Bescheid wie oben vorgesehen als schriftlicher Bescheid der IPEA gilt, so wird der Anmelder aufgefordert, bei der IPEA vor Ablauf von 3 Monaten ab dem Tag, an dem das Formblatt PCT/ISA/220 abgesandt wurde oder vor Ablauf von 22 Monaten ab dem Prioritätsdatum, je nachdem, welche Frist später abläuft, eine schriftliche Stellungnahme und, wo dies angebracht ist, Änderungen einzureichen.

Weitere Optionen siehe Formblatt PCT/ISA/220.

### 3. Nähere Einzelheiten siehe die Anmerkungen zu Formblatt PCT/ISA/220.

Name und Postanschrift der mit der internationalen  
Recherchenbehörde



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SCHRIFTLICHER BESCHEID DER  
INTERNATIONALEN RECHERCHEBEHÖRDE

Internationales Aktenzeichen  
PCT/DE2004/000528

**Feld Nr. I Grundlage des Bescheids**

1. Hinsichtlich der **Sprache** ist der Bescheid auf der Grundlage der internationalen Anmeldung in der Sprache erstellt worden, in der sie eingereicht wurde, sofern unter diesem Punkt nichts anderes angegeben ist.
  - Der Bescheid ist auf der Grundlage einer Übersetzung aus der Originalsprache in die folgende Sprache erstellt worden, bei der es sich um die Sprache der Übersetzung handelt, die für die Zwecke der internationalen Recherche eingereicht worden ist (gemäß Regeln 12.3 und 23.1 b)).
2. Hinsichtlich der **Nucleotid- und/oder Aminosäuresequenz**, die in der internationalen Anmeldung offenbart wurde und für die beanspruchte Erfindung erforderlich ist, ist der Bescheid auf folgender Grundlage erstellt worden:
  - a. Art des Materials
    - Sequenzprotokoll
    - Tabelle(n) zum Sequenzprotokoll
  - b. Form des Materials
    - in schriftlicher Form
    - in computerlesbarer Form
  - c. Zeitpunkt der Einreichung
    - in der eingereichten internationalen Anmeldung enthalten
    - zusammen mit der internationalen Anmeldung in computerlesbarer Form eingereicht
    - bei der Behörde nachträglich für die Zwecke der Recherche eingereicht
3.  Wurden mehr als eine Version oder Kopie eines Sequenzprotokolls und/oder einer dazugehörigen Tabelle eingereicht, so sind zusätzlich die erforderlichen Erklärungen, daß die Information in den nachgereichten oder zusätzlichen Kopien mit der Information in der Anmeldung in der eingereichten Fassung übereinstimmt bzw. nicht über sie hinausgeht, vorgelegt worden.
4. Zusätzliche Bemerkungen:

SCHRIFTLICHER BESCHEID DER  
INTERNATIONALEN RECHERCHEBEHÖRDE

Internationales Aktenzeichen  
PCT/DE2004/000528

### Feld Nr. II Priorität

1.  Das folgende Dokument ist noch nicht eingereicht worden:

- Abschrift der früheren Anmeldung, deren Priorität beansprucht worden ist (Regel 43bis.1 und 66.7(a)).
- Übersetzung der früheren Anmeldung, deren Priorität beansprucht worden ist (Regel 43bis.1 und 66.7(b)).

Daher war es nicht möglich, die Gültigkeit des Prioritätsanspruchs zu prüfen. Der Bescheid wurde trotzdem in der Annahme erstellt, daß das beanspruchte Prioritätsdatum das maßgebliche Datum ist.

2.  Dieser Bescheid ist ohne Berücksichtigung der beanspruchten Priorität erstellt worden, da sich der Prioritätsanspruch als ungültig erwiesen hat (Regeln 43bis.1 und 64.1). Für die Zwecke dieses Bescheids gilt daher das vorstehend genannte internationale Anmeldedatum als das maßgebliche Datum.

### 3. Etwas zusätzliche Bemerkungen:

**Feld Nr. V Begründete Feststellung nach Regel 43bis.1(a)(i) hinsichtlich der Neuheit, der erforderlichen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung**

## 1 Feststellung

Neuheit Ja: Ansprüche  
Nein: Ansprüche 1-8

Erfinderische Tätigkeit Ja: Ansprüche  
Nein: Ansprüche 1-13

Gewerbliche Anwendbarkeit Ja: Ansprüche: 1-13  
Nein: Ansprüche:

## 2. Unterlagen und Erklärungen:

**siehe Beiblatt**

**Feld Nr. VIII Bestimmte Bemerkungen zur internationalen Anmeldung**

Zur Klarheit der Patentansprüche, der Beschreibung und der Zeichnungen oder zu der Frage, ob die Ansprüche in vollem Umfang durch die Beschreibung gestützt werden, ist folgendes zu bemerken:

siehe Beiblatt

**Zu Punkt V.**

1 Im vorliegenden Bescheid wird auf folgende Dokumente verwiesen:

D1 : GIURGEA V. I.: "Hydrogeologische und geotechnische Voraussetzungen für die Anlage von Standorten zur Lagerung radioaktiver Reststoffe unter Berücksichtigung des Consolid-System" 1999, PROF. DR. KURT CZURDA UND PROF. DR. HEINZ HÖTZL, LEHRSTUHL FÜR ANGEWANDTE GEOLOGIE DER UNIVERSITÄT KARLSRUHE , KARLSRUHE , XP002289135

D2 : EP 1 155 732 A (REATEC GMBH) 21. November 2001 (2001-11-21)

**2 UNABHÄNGIGER ANSPRUCH 1**

2.1 Die vorliegende Anmeldung erfüllt nicht die Erfordernisse des Artikels 33(1) PCT, weil der Gegenstand des Anspruchs 1 im Sinne von Artikel 33(2) PCT nicht neu ist.

2.1.1) Dokument D1 offenbart (die Verweise in Klammern beziehen sich auf dieses Dokument) ein Mittel zum Abdichten von Bauwerken (Seite 34), das aus einem Gemisch aus Erdstoff (Seite 34, Zeile 4,5), vorzugsweise tonige Materialien und/oder Schluff (Seite 23, Zeile 18 - 23), und einem das Hüllwasser um das Korn aufbrechenden Zusatzstoff besteht, wobei 1 m<sup>3</sup> Erdstoff 0,04% des Zusatzstoffes enthält (Seite 33, Zeile 32 - 39).

Es soll darauf hingewiesen werden, daß in der vorliegenden Anmeldung (siehe Seite 5, Zeile 9) als ein das Hüllwasser um das Korn aufbrechend Zusatzstoff das Consolid System gebraucht wird.

2.1.2) Dokument D2 offenbart (die Verweise in Klammern beziehen sich auf dieses Dokument) ein Mittel zum Abdichten von Bauwerken, das aus einem Gemisch aus Erdstoff, vorzugsweise tonige Materialien und/oder Schluff, und einem das Hüllwasser um das Korn aufbrechenden Zusatzstoff besteht (Spalte 2, Zeile 48 bis Spalte 3, Zeile 1).

**3 ABHÄNGIGE ANSPRÜCHE 2-7**

3.1) Die Ansprüche 2-7 enthalten keine Merkmale, die in Kombination mit den Merkmalen irgendeines Anspruchs, auf den sie sich beziehen, die Erfordernisse des

PCT in Bezug auf Neuheit bzw. erfinderische Tätigkeit erfüllen

**4 UNABHÄNGIGER ANSPRUCH 8 und ABHÄNGIGE ANSPRÜCHE 2-7**

4.1) Die Lehre von D1 (siehe Seite 34, Zeile 4,5 und Seite 34, Zeile 18 bis zum Ende) wurde den Fachmann zwangsläufig zu dem in Anspruch 8 beschriebenen Verfahren führen.

4.2) Die Ansprüche 9-14 enthalten keine Merkmale, die in Kombination mit den Merkmalen irgendeines Anspruchs, auf den sie sich beziehen, die Erfordernisse des PCT in Bezug auf Neuheit bzw. erfinderische Tätigkeit erfüllen

**5 Klarheit**

Die Anmeldung erfüllt nicht die Erfordernisse des Artikels 6 PCT, weil der Anspruch 1 nicht klar ist.

Der Ausdruck "das Hüllwasser um das Korn aufbrechenden Zusatzstoff" ist nicht zu verstehen.

**VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT  
AUF DEM GEBIET DES PATENTWESENS**

Absender: ANMELDEAMT

An	Dr. Weber, K. Seiffert, Dr. Lieke	PCT
Patentanwalt Dieter Weber Postfach 61 45 65051 Wiesbaden	12. Mai 2004	MITTEILUNG DES INTERNATIONALEN AKTENZEICHENS UND DES INTERNATIONALEN ANMELDEDATUMS
Termin:		(Regel 20.5 c) PCT)
Absendedatum (Tag/Monat/Jahr)		06. Mai 2004
Aktenzeichen des Anmelders oder Anwalts <b>#CONSOL 103-01-WO</b>		WICHTIGE MITTEILUNG
Internationales Aktenzeichen <b>PCT/DE 2004/000528</b>	Internationales Anmelddatum (Tag/Monat/Jahr) <b>16. März 2004</b>	Prioritätsdatum (Tag/Monat/Jahr) <b>19. März 2003</b>
Anmelder <b>Consolid Technik Deutschland GmbH u.a.</b>		
Bezeichnung der Erfindung <b>Mittel und Verfahren zum Abdichten von Bauwerken</b>		

1. Dem Anmelder wird mitgeteilt, daß der internationalen Anmeldung das oben genannte internationale Aktenzeichen und internationale Anmelddatum zugesprochen worden ist.

2. Weiterhin wird dem Anmelder mitgeteilt, daß das Aktenexemplar der internationalen Anmeldung

dem Internationalen Büro am 06. Mai 2004 übermittelt worden ist.

dem Internationalen Büro aus dem unten angegebenen Grund noch nicht übermittelt worden ist, das Internationale Büro aber ein Exemplar dieser Mitteilung erhalten hat.

Die erforderliche Überprüfung aufgrund nationaler Sicherheitsbestimmungen ist noch nicht erfolgt.

(Angabe des Grundes)

\* Das Internationale Büro überwacht die Übermittlung des Aktenexemplars durch das Anmeldeamt und unterrichtet den Anmelder über dessen Eingang (mit Formblatt PCT/IB/301). Ist das Aktenexemplar bei Ablauf des vierzehnten Monats nach dem Prioritätsdatum noch nicht eingegangen, teilt das Internationale Büro dies dem Anmelder mit (Regel 22.1 c)).

Name und Postanschrift des Anmeldeamts <b>DEUTSCHES PATENT- UND MARKENAMT 80297 München</b> Telefaxnr. (0 89) 21 95 - 22 21	Bevollmächtigter Bediensteter <b>Beyer</b> <i>Beyer</i> Telefonnr. (0 89) 21 95- 4724 /ml
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